ENVIRONMENTAL QUARTERLY

April • 1959

The Pioneer Space Age Publication of Environmental Simulation, Testing, Engineering and Equipment Manufacturing

INDEPENDENTLY PUBLISHED

Volume 5 • Number 2

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GULTON SHOCK AND VIBRATION DATA FIL

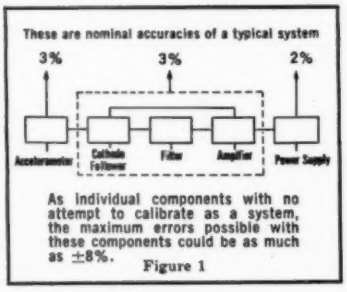
How to simplify measurement of shock and vibration

Basically, the solution to more accurate shock and vibration measurement lies in the application of completely integrated sub-systems as against combinations of individually specified components.

SYSTEM MATCHING A PROBLEM

The disadvantages associated with properly matching the individual sections of a measurement sub-system are many.

Figure 1 shows typical specifications for a sub-system comprising accelerometer, cathode follower, filter, amplifier, cables and connectors, and power supply.



As individual components with no attempt to calibrate as a system, the maximum errors possible with these components could be as much as ±8%.

Figure 1

Note that while accuracy of individual components may be ±3% maximum over-all system accuracy can only be calculated within ±8%. Need for improving system accuracy thus results in over-specification of component parts, consequent loss of frequency range and sensitivity, and usually, greater expense.

The most obvious disadvantage of this method is the inherent difficulty and loss of time spent in finding and matching component sections most compatible with each other—as well as the difficulties of dealing with more than one supplier.

ADVANTAGES OF COMPLETELY INTEGRATED SUB-SYSTEMS

The function of any shock and vibration measurement sub-system is to provide a signal proportional to the actual acceleration encountered.

Albert Gillen, Senior Engineer Calibration Laboratory

Much higher levels of accuracy can be established — indeed guaranteed —with no sacrifice of range or sensitivity with complete design and integration by one responsible organization.

As a rule, system performance can be further improved, in terms of weight and size, by the possibility of eliminating certain components, as for example cables and connectors, through the system design. Filter circuits can be incorporated in the amplifier.

SIMPLE CALIBRATION

Still another and very important advantage is that of easy calibration. In a Gulton integrated sub-system, component parts are designed with maximum compatibility—and are calibrated as an over-all system to provide the required full range of outputs. Provision can be made for field-calibrating the entire system through just two connection points —reducing preparation test time to a minimum.

SEND FOR TECHNICAL DATA

For more complete information on Gulton *completely integrated* measurement systems, contact your local Gulton representative, or write us direct.

CALL ON GULTON FOR FREE TECHNICAL SERVICE

Because Gulton designs and supplies completely integrated sub-systems for shock and vibration measurement, we can fully understand your problems. You are invited to put this extensive knowledge and experience to work for you.

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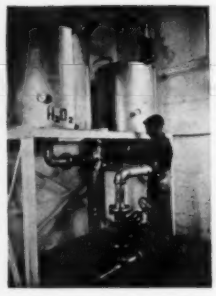
Thorough planning and pre-test study is a vital phase of creative test engineering.



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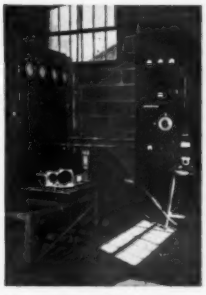

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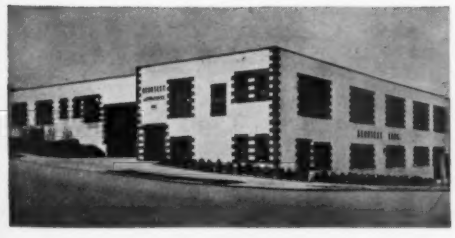

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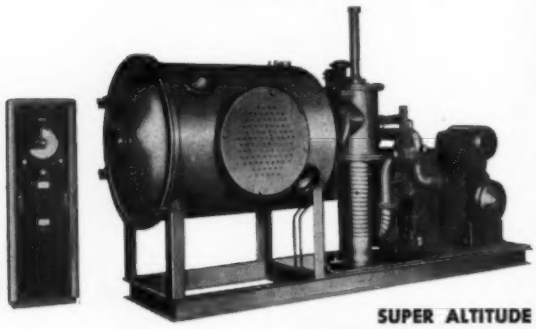

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ENVIRONMENTAL QUARTERLY

The Pioneer Space Age Publication of Environmental Simulation, Testing, Engineering and Equipment Manufacturing.

APRIL • 1959 **Vol. 5 • No. 2**

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At the half-way point, some results are discussed of an extended test of storage environments.

Creating Super Get-Up, Super Go, Super Heat

An EQ staff report on Lockheed's powerful "G-Shooter" and "hotshot" wind tunnel, which outheats the sun.

SPECIAL FEATURE

A Universal Vibration Holding Device

by E. Robert Britton, Electronic Communications, Inc.

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Events of interest to those who work with environments

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POST SCRIPTS • A report from the editor of EQ •

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Post Scripts

The reception accorded the January issue of **Environmental Quarterly**, the first under independent auspices, was exhilarating. Either because people are nice, or because they meant it, their comment was all good. No one had a bad word for us.

This is not necessarily the best environment for journalism, because it takes complaints to keep a publication on its toes.

Has Quarterly hit upon the best formula for serving the various segments of the environmental industry? Maybe so, but we doubt it. We think that a magazine devoted to a field that by definition is always testing and exploring should do a little experimenting on its own.

This viewpoint is reflected in these pages. Our purpose is not to be radically different each issue, but to inject enough variation in style and content to keep Quarterly at the head of the class.

We'll appreciate your reaction, suggestions—and criticisms.

Quo Vadis, Environment?

Where is the business of environments going?

Are the prospects good or bad?

What scientific advances are in the offing?

These are boiled down versions of questions **Environmental Quarterly** asked in a recent random mailing to readers and advertisers. Ten per cent of those queried offered their views—not a bad return, at that.

While the poll would hardly rate as "scientific" among professional pulse takers, the results are certainly worth considering as an indication of how the industry feels.

It seems to feel fine, thank you.

For a report on **Environmental Quarterly's** survey, turn to "Envi-

(*Continued on Page 20*)

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AROUND THE ENVIRONS...

Environmentalists Heading For Biggest Ever Annual Meeting

Environmental scientists and engineers from all corners of the country are heading for Chicago for what undoubtedly will be the biggest annual meeting and trade show ever held by the industry.

More than 50 technical papers are slated for presentation at the three-day affair, Wednesday through Friday, April 22-24, sponsored by the Institute of Environmental Engineers. It will be the IEE's fifth annual meeting, the first since the engineering organization struck out on its own.

Concurrently with the technical sessions, an industry-wide trade show will be in full swing, also at the La Salle Hotel. While the number of exhibitors has not been announced, the IEE expects it, too, to set a new record.

Group luncheons are scheduled for the first two days. At one of them Dr. Daniel Q. Posin, De Paul University physics professor and Chicago broadcaster on scientific subjects, will speak on "Space Energy and the Theory of Relativity."

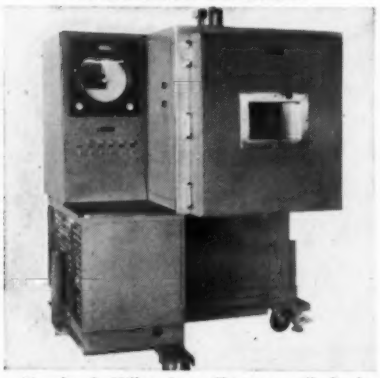
Plans have been made to keep wives entertained while their husbands attend to science and business. For the distaff side there will be a fashion show and a special luncheon.

The technical program as announced will cover these general areas:

1. Shock and vibration (R. Lowe, Barry Controls; W. C. Hansen, Martin-Denver; R. A. Hirsch, Aircraft Armaments; J. Munro, Lear, Inc.; K. K. Eppele, Wyle Research; A. Howard, U. S. Naval Research Lab; G. Booth, M. B.

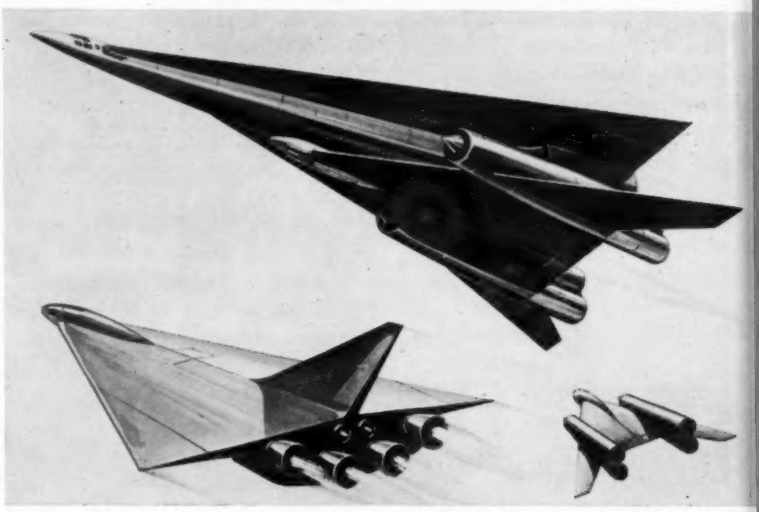
(Continued on Page 32)

To Be Seen At Show



Murphy & Miller, Inc., Chicago, will display this new high-low temperature chamber, to be used with a vibration unit, at the trade show. Lifting jacks permit self-elevation.

In the Spring, Airplane Designers' Fancies . .



Marquardt Aircraft's idea of tomorrow's commercial transports, with ramjet-turbojet power to reach speeds in the multiple Mach numbers.

Mach 5 commercial transports are practically a reality in the minds of aircraft designers and maybe not so far off in actuality.

Roy E. Marquardt, president of Marquardt Aircraft Company, sees tomorrow's commercial plane as a ramjet job with afterburning turbojets to help in takeoff and initial acceleration. The ramjets would take over at Mach 2 at 30,000 feet and cruise along at Mach 4 and 80,000 feet to reach the opposite coast in an hour.

We've got the know-how, Mr. Marquardt says in effect. All that is necessary now is to establish the need and practicality of supersonic transport.

According to R. C. Sebold, engineering vice president of Convair divisio of General Dynamics Corp., a Mach passenger plane could go into produ tion today and be delivered by 196 only it's not likely any airline will wa it because by 1970 Mach 3 to 5 tra ports will be the vogue.

Structurally Mach 3 to 5 planes pro ably won't look much like today's b cause of factors such as the need to di sipate the tremendous heat generate by aerodynamic friction on skin su faces. Mr. Sebold suggests circulatin water as one means of cooling supe sonic cabin walls. And most likely, h says, there won't be any windows i tomorrow's airplane to help make sur that cabin pressurization doesn't fail.

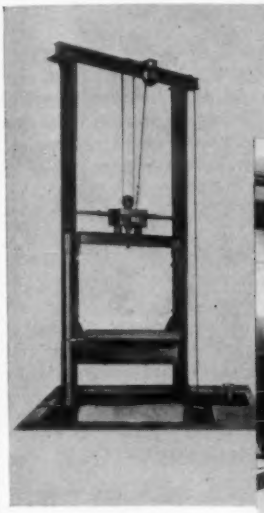
Many Environmental Exhibits

The huge IRE show drew many environmental exhibitors to New York's Coliseum last month, and many of the 60,000 scientists and engineers who tramped through the big show palace from March 23 to 26 were in the environmental field.

Indeed, the IRE people themselves gave the environmental industry special attention. The biggest piece of equipment among the 950 exhibits, the IRE press department announced, was Ling Electronics' new, giant shaker (See EQ's Album, Page 19, and "Environmental Business, Page 30.) In publicity release, the IRE said the 25,000 pounds-force "behemoth" was "capable of crumbling the Coliseum's walls" and that it wasn't turned on for fear it might do just tha since proper installation was no feasible.

Other IRE exhibitors in the en vironmental field included: Ace En gineering & Machine Co., Inc; Acto Laboratories; Associated Testing Labo atories, Inc.; Blue M. Electric Co.; Con rad, Inc.; Electric Hotpak Co., Inc Genisco, Inc.; Hastings-Raydist, Inc International Radiant Corp.; MB Manu facturing Co.; MM Enclosures, Inc NRC Equipment Corp.; Precision Sc entific Co.; Reeves Instrument Corp Robinson Aviation Co.; Shielding, Inc Tenney Engineering, Inc.; United State Testing Co., Inc.

BELOCK *tests for* SHOCK SHOCK SHOCK



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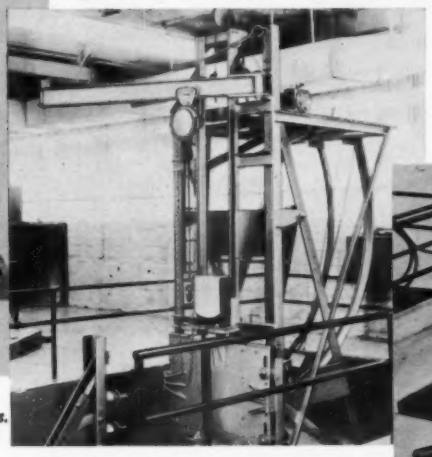
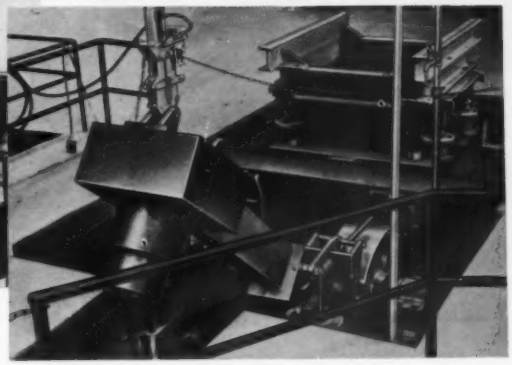


High-Impact Shock Testing Machine for Light Weight Equipment
Specimen weights to 400 lbs.
Two 400 lb. hammers
Certified by U.S. Navy
Applicable to MIL-S-901B
MIL-T-17113



High-Impact Shock Testing Machine for Medium Weight Equipment
Specimen weights to 4,000 lbs.
Peak accelerations to 1000 g's
Hammer weight — 4000 lbs.
Table travel pneumatically controlled
Certified by U.S. Navy
Applicable to MIL-S-901B
MIL-T-17113

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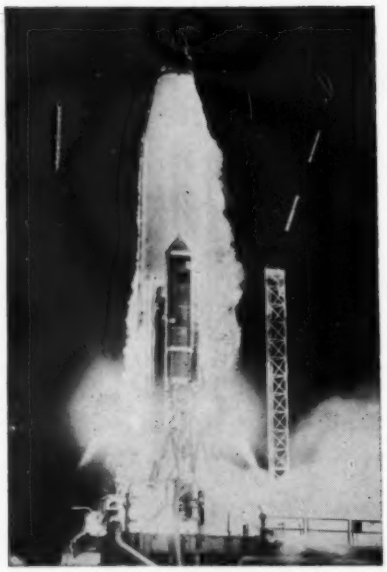
Testing the 'Talking' Atlas

by
Richard S. Campbell
Chief of Test Laboratories
Convair-Astronautics Divisi

(A scant four months ago—a long time as our breathless space age goes—a stainless steel goliath rose majestically into space and went into orbi all 8,750 pounds of it. What impressed mere man as much as its weig was the fact that the missile talked, and in that Christmas season it beame to earth a message from on high: "Peace on earth and good will to me everywhere." Here is an environmental view of the development of th missile.)



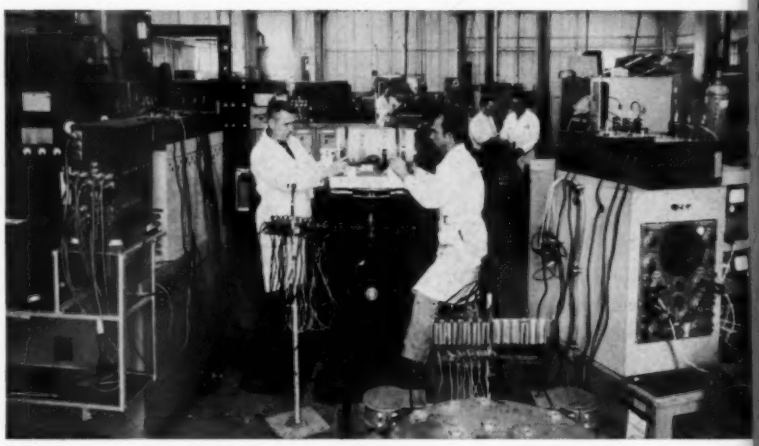
The "Talking" Atlas as it rose from Cape Canaveral last Dec. 18 for a month-long spin around the Earth.

On Dec, 18, 1958, Atlas Missile 10B was flown from Cape Canaveral, Florida.

The men who conducted the firing hoped that the missile would set a new long distance record but even their wildest dreams did not include a distance represented by 31 days travel 18,000 miles per hour (approximate 34,000,000 miles).

Before the launching crew had r covered from the shock of the "birt being in orbit around the earth, th found that there was something el

Free Space room at Convair-Astronautics, builders of the mightly Atlas, for corona testing of electrical parts and antennas, which can be subjected to altitudes of up to a million feet and broadcast up to 300 watts with no reflections above 200 megacycles.



A view of the 6,300-square foot Convair-Astronautics environmental te lab (above), where 14 chambers provide temperatures from —100°F t +1200°F and altitudes to 100,000 feet. Below are some of the 11,20 square feet Convair devotes to 13 vibration systems for Atlas testing Forces up to 25,000 pounds sinusoidal or 42,000 pounds instantaneou peak on white noise are available.

Centrifuge provides combined environment of one ton to 100 Gs, with temperature of —100 to +350°F available in gondola test chamber.

RICHARD S. CAMPBELL

Richard S. Campbell is a 1941 graduate of Texas A & M, with a degree in petroleum and mechanical engineering. After five years in the Coast Artillery, where he rose to the rank of major, he held positions as chief engineer with several small southern California firms. He joined Convair as a design engineer at Pomona in 1951. Early in 1952 he went to San Diego to take charge of test coordination on the Terrier missile, returning to Pomona in mid-1952 to organize a crew for the electronic component test lab for the Terrier project. Two years later he became contract coordinator for all electronics and hydraulics sub-contract work on the Terrier project, and in January, 1955, he moved to the Astronautics division to take charge of its test labs.

Convair-Astronautics—home of the Atlas missile—at San Diego, Calif.

very different about this "bird"—it could talk back. For years missile men had suspected certain missiles of being possessed of characteristics generally considered to be natural only in human beings, but this was the first real proof.

The story could simply end here with the first missile "boosting itself" into orbit and then bragging on itself by talking for days so no one could forget it was out there, but the big story lies in how all of this was accomplished successfully on the first try.

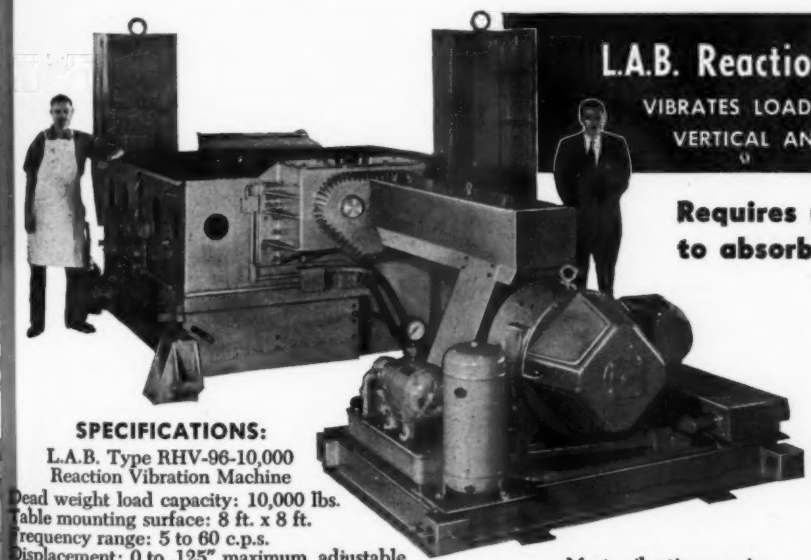
The real foundation for the success of the talking Atlas was laid several years ago when the first model tests were conducted to prove the theories on which the Atlas design was based. This was followed by a comprehensive environmental test program on all components: vibration, acceleration, temperature, humidity and altitude. The "B" series Atlas missiles were proved out in an extensive test program which began at the component level in the environmental test laboratory and ended in flights conducted at Cape Canaveral in the flight test program.

The talking part of Missile 10B was the joint effort of the Army Signal Corps and Convair Astronautics. The Signal Corps designed, built and tested the packages containing the memory unit as well as the transmission and receiving equipment. These were all tested in the environments that were anticipated outside of the Earth's atmosphere.

The mission of 10B was a secret. Even the engineers who tested the parts at Convair did not know what the parts were for or why they were to be tested to what appeared to be strange environments.

After the testing was completed, and

(*Continued on Page 11*)



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Requires no special foundation to absorb reactive forces

SPECIFICATIONS:
L.A.B. Type RHV-96-10,000
Reaction Vibration Machine
Dead weight load capacity: 10,000 lbs.
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Frequency range: 5 to 60 c.p.s.
Displacement: 0 to .125" maximum, adjustable
Acceleration ratings: 10G
Direction of vibration: Vertical and horizontal
Maximum force output of vibration generators: 310,000 lbs.
Shipping weight: 30,000 lbs.

Meets vibration requirements of MIL-STD-167 and others.

This is one of L.A.B.'s complete line of vibration machine systems with load capacities from 50 to 10,000 lbs. and table areas from 18" to 96" sq. Frequency ranges up to 100 c.p.s. and acceleration ratings up to 20G with load capacities up to 1000 lbs. Larger units up to 60 c.p.s. and 10G. Available for constant displacement or both constant displacement and constant acceleration sinusoidal tests.

Changes of direction of vibration and displacement settings made in minutes with load in position. Torque bar suspension prevents transmittal of generated vibrations to floor, even with force outputs over 300,000 lbs.

L.A.B. ALSO MANUFACTURES:

- Non-electronic hydraulic sinusoidal vibration systems with force ratings to 20,000 lbs., frequency ranges 50 to 600 c.p.s.
- Oil film supported auxiliary vibration tables for use with high frequency electrodynamic or hydraulic vibrators.
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- 6,000 lb. capacity quick release hooks.
- Shock testers.

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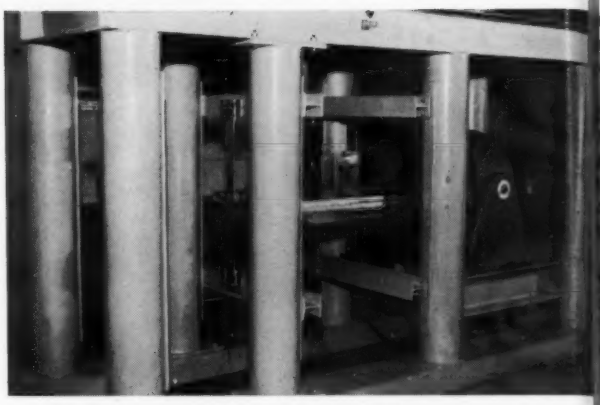
One of the problems that plagues manufacturers of electronic systems—getting maximum utilization out of their vibration laboratories by eliminating extraneous set-up time—was solved at Electronic Communications, Inc. with a universal vibration holding device. Here's how ECI designed and built the device around a 1,250-force-pound exciter.



ECI's Universal Vibration Holding Device
Showing Auxiliary Table in the Horizontal Plane

A Universal Vibration Holding Device

. . . for increased lab efficiency

by
E. ROBERT BRITTON
Project Engineer
Electronic Communications, Inc.

MIL-E-5752, MIL-T-5422, or MIL-E-5400 and the appropriate component specifications require that a specimen be vibrated sinusoidally in each of three mutually perpendicular planes, from 5 to 500 cps. Test components of approximately 200 cubic inches can be handled with a cubic fixture or other appropriate holding device, but what about specimens of more than 600 cubic inches—plus a holding device on the exciter head—which have to be shaken in each of three mutually perpendicular planes while cognizance is retained over the system being tested?

To complicate matters further, other portions of the system are awaiting vibration.

A universal holding device appears to be the answer, but it has to fulfill at least these three basic requirements:

¶ It has to support the 2,000-pound exciter.

¶ Mechanical resonances must be of low magnitude with in the test spectra.

¶ The device should be movable should the lab be r arranged.

The universal vibration holding device evolved at EC consists of 8 eight-inch steel columns, each about six fe long, welded to an eight-inch channel structure 10 feet lon and 3½ feet wide and capped by an eight-inch wide flang structure of the same dimensions. A platform of eight-inc flange steel is welded between two of the extreme pai of columns to support th exciter, which is har mounted to the structure.

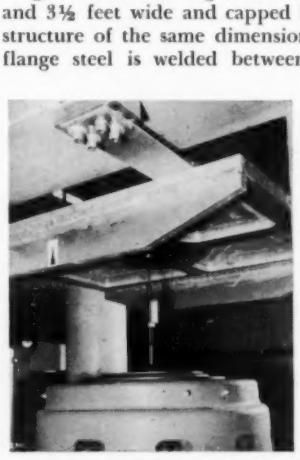


Figure 1

A unique feature is tha one pair of columns is ad justable along the device length to accommodate aux iliary tables or holdin structures of varying length

Figure 1 shows the ver tical table suspended be tween the beams by fou flexures. Each flexure is 1 inches long, 3 inches wid and made of 3/16-inch aluminum. A resonanc search of this table and the conventional drive mech anism showed that the force transfer rods were extremel rich in resonances, and that table load had to be centere immediately over the exciter. This system also limited the excitation frequency to the spectra between 55 and 500 cp since a rocking mode was evident below 55 cps. Incidentally the weight of this table is 71 pounds, but due to the stiff

E. Robert Britton

Bob Britton is a 32-year-old native of New York who has found a Florida environment to his liking. He is now responsible for designing and fabricating environmental facilities for Electronic Communications, Inc., St. Petersburg, Fla. He studied at Michigan State College, the Lincoln School and the University of Akron, and currently is a candidiate for a doctorate. His memberships include the IRE, American Society of Tool Engineers and the Aircraft Electrical Society. A radio ham, Bob holds License K4VYG. Material in the accompanying articie was first developed for a paper he read last February at the 27th National Shock and Vibration Symposium at Fort Bliss, Texas.

ness of the supporting flexures it does not apply any appreciable static load to the exciter. The table hole patterns are an exact duplicate of those holes in the exciter head. The span between the exciter and the table bottom is 21½ inches, a considerable length for a flimsy structure. To counteract the rocking effect, resonances and ineffective drive structure, it was thought that if a drive link were fastened to each mounting hole on the exciter head and then to the table, the same effect as a cylindrical drive would be true.

Another reasonance search, with the new configuration, was conducted and resonances equally as bad or worse than the singular drive were found, although the rocking mode was no longer evident and the test spectra were now extended to encompass the area from 5 to 500 cps.

Elimination of the resonances was accomplished by the design of the cylindrical pedestal shown in Figure 2. It is 21½ inches long with a tube diameter of 4½ inches. Both the 10-inch diameter flanges and tube are made of aluminum. The bolt holes are on eight-inch centers, matching the exciter layout.

Figure 2

Engineering calculations of the tube fixed at both ends were made and this resonance was found to be approximately 2,400 cps.

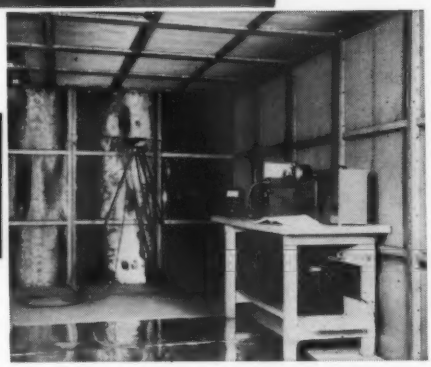
It is obvious that to span a distance of 20-plus inches a structure stiff in all directions is necessary. Since weight is an important factor an aluminum tube with a wall thickness of only .05 inches was used. The overall weight of the extension pedestal is eight pounds, about 30% greater than the standard force links, certainly not a prohibitive weight increase.

With proper alignment and pre-engineered fixtures, should lateral motion incident to the direction of drive be virtually non-existant? The lab tested this by tieing the drive pedestal to the vertical table and in turn through flexures to the universal vibration holding device in the vertical plane. (Maximum assembly time between exciter head and auxiliary table was five minutes as compared with 45 minutes when standard drive mechanisms were used.) There were virtually no resonances, as compared with

(*Continued on Page 10*)

Figure 3

Now Radio Interference Testing has been added!



Acton Laboratories complete environmental testing laboratories provide Radio Interference Testing plus consulting services.

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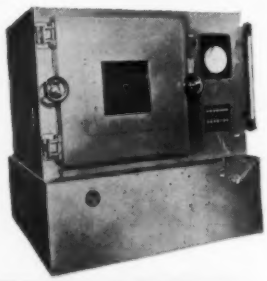

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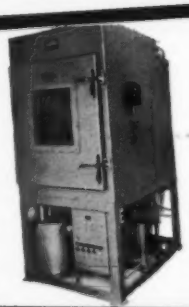

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Vibration Holding Device

(*Continued from Page 9*)

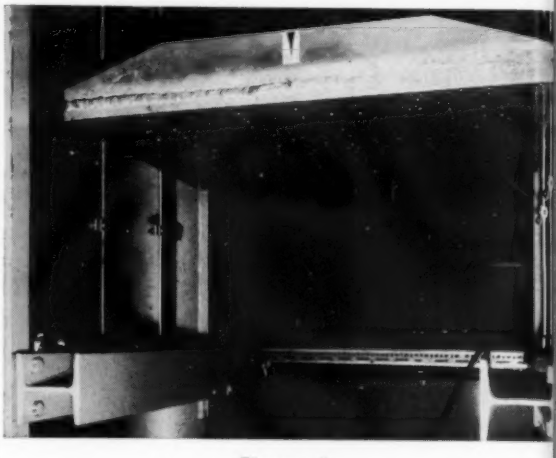

Figure 4

resonant rich structures, and spectrum limits were to spe fications 5-500 cps, as compared with previously limit spectra.

The universal vibration holding device makes it possib to test many different specimen configurations. Figure shows a rail frame structure used to test a 65-pound f quency counter, mounted on vibration isolators. The cg this specimen was eight inches from the bottom dimensi and the isolators were fastened parallel to this point—hence the rail frame. The frame was connected to the holding d vice through four 36-inch aluminum flexures made of Q A-327 aluminum four inches wide and 3/16 inches thic The rail frame was located in the center of the four flexur by a 3/8 bolt through the flexure and frame. A standa drive was used to transfer energy from the exciter to t table. Although physically the same, the four flexures we found to have different dynamic resonaces. Detuners we designed and manufactured, and have been used successfull to maintain dynamic balance.

Changes Planes Easily

By use of the rail frame structure the specimen und test can be changed from the major to the minor horizont planes with a minimum of effort.

ECI's general purpose auxiliary vibration table is show in Figure 4. It is used for both horizontal and vertical mod and is easily transferred between the planes. The table 30 x 24 x 1 with a 3 x 30 x 1 stiffening gusset on each si heliarced the length. Static weight is approximately pounds.

The entire system has a system resonance calculated at cps. Since this is in the test range it is avoided when nec sary, although it has been used to advantage on other casions. The flexure resonances are in the 36 cps region, though this is varied through the use of detuners.

Propulsion Test Facilities

In New Haven, Conn., last month MB Manufacturing C a division of Textron, Inc., announced the formation of affiliate, Propulsion Test Facilities, Inc., "to meet the critic need for improved aircraft and missile reliability."

'Talking' Atlas Testing

(Continued from Page 7)

the engineers had "doped out" the possibility of an orbital shot from the frequencies of the filters, an order came canceling all effort to put 10B into orbit. This order was later changed—but it was not published.

Although designing filters for the normal missile temperature environments has been a well established procedure for some time, it was neccesary to prove that the filters in the radiation system would stay in tune under temperature shock (rapidly changing) conditions. These conditions were simulated by installing the filters in an altitude chamber, taking the chamber to 95,000 feet and applying radiant heat so that a change of 10°F per minute was achieved. Needless to say the filters performed their function.

Missile 10B was only a link in a chain starting with an idea and culminating in an operational missile in the hands of the U. S. Air Force to deter aggression. All of the links have not been forged at this writing, nor have they been tested.

Even today new ideas are being converted to hardware to be thoroughly tested through the environments before being flight tested, just as elements of the talking Atlas went through Convair Astronautics' extensive environmental test labs in the San Diego area.

The flight of 10B confirmed the calculations of the engineers who believed it could place itself in orbit. It also opened up infinite possibilities of communication relay stations orbiting the Earth. One needs only mild imagination to envision the future possibilities—both military and civilian.

Point Loma test site, San Diego, where Atlas pressurization, flow and large structural tests are performed.

COMPANIES AT WORK

A complete radio interference testing facility has been added to the extensive environmental test laboratories of *Acton Laboratories, Inc.*, Acton, Mass. (See EQ's Album, Page 19). With its new equipment, Acton can provide field intensity measurements, RF interference measurements to commercial and military specs, antenna pattern analysis, determination of harmonic spurious frequency output of transmitters, local oscillator radiation of receivers and determination of shielding effectiveness.

Development Engineering Co., Norwalk, Conn., recently completed a machine for testing silicon diodes. The unit test at high temperatures and classifies according to voltage at the rate of 2,000 per hour.

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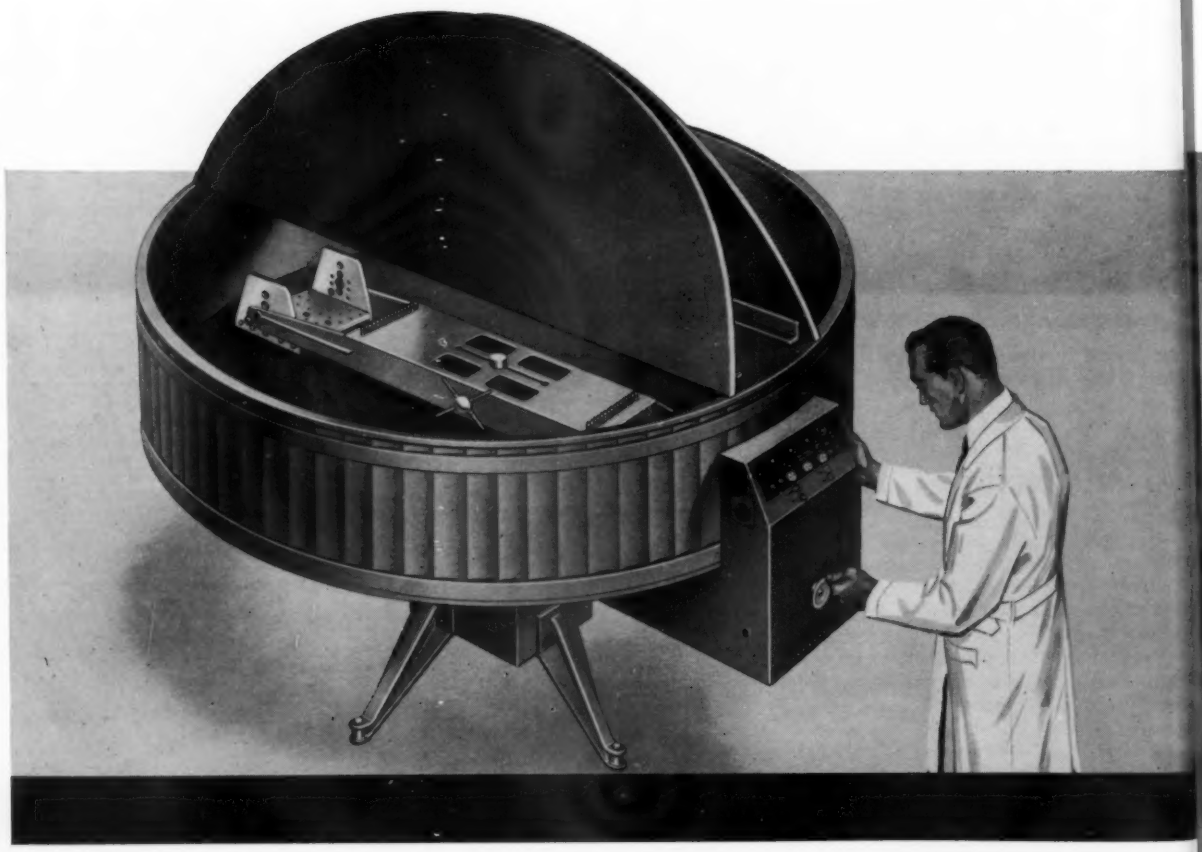


The low-cost answer to fast, accurate testing of components under simulated operational g-forces as required by MIL-E-5272A.

These new precision centrifuges feature a unique, high-torque ball-disc integrator drive system which provides accuracies you would expect only from a rate-of-turn table. Constancy of boom rotation, including wow and long-term drift, is better than .05% at any speed setting—approximately 10 times more accurate than currently available machines. Boom speed is infinitely variable and is measured by an electronic counter built into the console.

The building block design concept gives the new centrifuges exceptional flexibility. Machines are assembled from six basic off-the-shelf components; drive system, drive motor, boom, test compartment, console and accessories. You simply select components which provide features needed to meet your specific requirements. Interchangeability of the components permits easy modification as requirements change. Kits are available for modification by the customer.

This new design concept also results in manufacturing economies which are reflected in the cost of the machines. *The new machines are the lowest priced centrifuges now available—in spite of their greater accuracy, flexibility and capacity.* Ask your Genisco representative for complete information today.

There are more than 400 Genisco centrifuges now in operation.

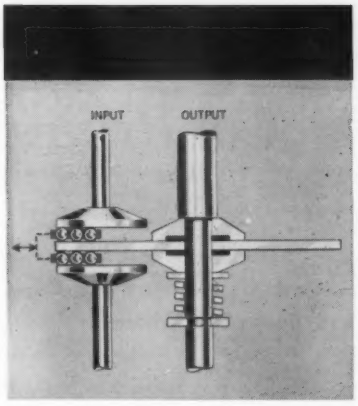
Genisco INCORPORATED

2233 Federal Avenue, Los Angeles 64, California

brief performance specifications

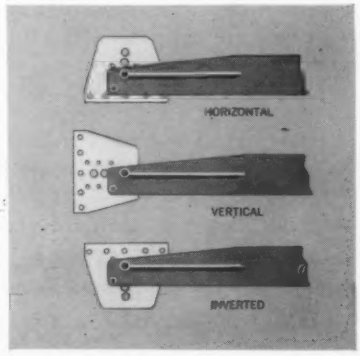
Model No.	Diameter	Test Object Weight	Capacity G-pounds	RPM Max.	G-Range Max.	Test Object Dimensions
A-1010	30" table	50 lbs. dead weight	2,500	800	.1 to 200 g's	
A-1020	60" arm	100 lb. dead weight	10,000	600	.1 to 250 g's	12" cube
A-1030	96" arm	100 lb. dead weight	10,000	400	.1 to 175 g's	18" cube

Large custom centrifuges: Genisco centrifuge experience includes the design, manufacture and installation of large custom-built machines. We invite your inquiry.



Entirely new, more efficient drive system—An integral variable speed transmission based on the new *Rouverol* *ball-galaxy principle achieves, for the first time in rotating machinery, high torque characteristics while maintaining the inherent accuracies of a hardened steel-to-steel ball-disc integrator. A novel choice of geometry among the drive elements results in a virtually linear handwheel vs rpm relationship, thus facilitating the presetting, programming and servo-controlling of output speeds. A built-in torque-limiter clutch protects the transmission from damage resulting from abuse or high inertia conditions.

*Pat. Pending



Basket-type mounting platforms, available on Model A-1020 and A-1030, may be oriented from the horizontal to the vertical or to the inverted attitude for multiple-axis testing without demounting the test object. Baskets may be raised or lowered to achieve an optimum dynamic balance and minimum angular deflections when extreme accuracies are required. When the basket is inverted the outside surface of the platform may be used to mount bulky, lightweight packages.

Available accessories include additional slip rings, servo control, microwave joints, high pressure air and hydraulic systems, TV viewing systems. Any accessory can be added *at any time* by the user. The mounting base is standard equipment.

Comparative Storage Conditions Test

Some results of a test the Bureau of Yards and Docks is conducting at its Naval Civil Engineering Research and Evaluation Laboratory, Port Hueneme, California to determine the relative efficiency of different types of storage environments in preventing deterioration of camp equipment and smaller types of automotive and construction equipment utilized by the Seabees.

by GEORGE W. HIGGS, JR.

Manager, Marine Corps Supply and Research Facilities Branch
Bureau of Yards and Docks, Navy Department

Five storage environments are included in the test: open storage, shed storage, conventional warehouse, controlled humidity warehouse (50% RH), and controlled humidity warehouse (40% RH). Each storage area ocupies 4000 sq. ft.

The open storage area has a bituminous pavement. The shed is a prefabricated steel frame building with both siding and roofing of sheet metal, and the siding omitted on the lee side with respect to prevailing wind. The conventional warehouse is similar, but completely enclosed and insulated to simulate the fairly steady indoor temperatures of a large warehouse.

The controlled humidity warehouses duplicate the conventional warehouse except that they are sealed against air infiltration, and are equipped with dry dessicant-type dehumidifiers to maintain a relative humidity not in excess of the required 40 or 50%. In erecting the controlled humidity warehouses, corrugation closures are used at the juncture of wall and roof, all laps of siding and roofing are caulked with a bituminous compound, doors are weather stripped and floors are of dense-mix bituminous concrete.

Each specimen was cleaned minutely after detailed disassembly, the parts photographed, and then reassembled. Prepared specimens were placed in the open storage and shed environments in July and August, 1955, respectively, and in three enclosed environments about January, 1956.

Nineteen pairs of different items were placed under both open storage and shed conditions; thirty-one pairs, in each enclosed condition. One item of each pair was left in a condition similar to a new item shipped from a factory to a dealer selling to civilian consumers, and does not include any special preservative treatments. This is referred to as 'domestic treatment.' The other item of each pair was given contact preservation treatment in conformance with Bureau of Yards and Docks manual, "Preservation, Packaging, and Packing of 'C' Cognizance Material, TP-PW-14."

The test is scheduled to run for five years. At midpoint definite trends are evident as summarized in Charts No. 1 and 2. Chart No. 1 depicts the total number of critical rust areas occurring on all 'domestic treatment' specimens under the different storage conditions. Rust on an area critical to operation or use of the equipment is counted as a critical rust area; rust on a noncritical area is not counted. Comparable data for the 'contact preserved' specimens are shown on Chart No. 2. The tick marks indicate the point at which an identified item reached a degree of deterioration

Deterioration Curves for Domestic Treated Items showing total accumulated rust areas in each environment and the length of storage time beyond which certain items were no longer in a "satisfactory-for-issue" condition.

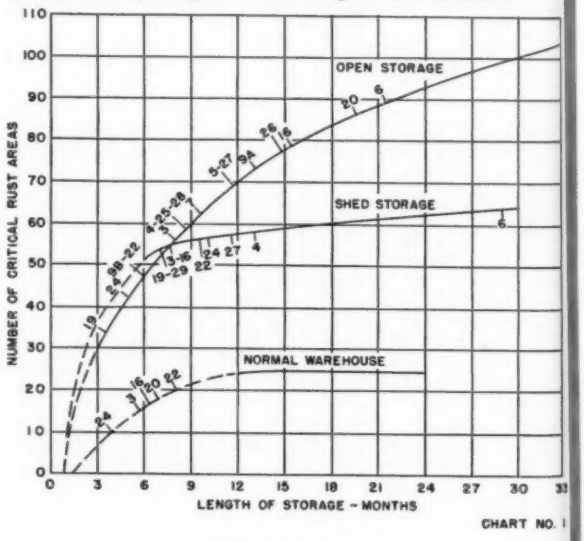


Chart No. 1

LIST OF ITEMS IDENTIFIED BY TICK MARKS

3. Compressor set, 30 cfm
4. Diaphragm pump, 3000 cfm
5. Centrifugal pump, 350 gpm
6. Floodlight trailer
7. Generator, 30 kw
9A. Power plant for 60 in. searchlight
9B. Searchlight, 60 in.
16. Arc welder, 300 amp
19. Vertical boiler, 180,000 Btu
20. Distillation unit, 83 gpm
22. Bake oven
24. Oil fired heater, 50,000 Btu
25. Washing machine
26. Refrigeration panels
27. Refrigeration unit
28. Dump truck, 2½ ton
29. Jeep, ¼ ton

Mr. Higg's article is being reprinted from the PDC NEWSLETTER of the Prevention of Deterioration Center, National Academy of Sciences.

which necessitated overhaul before issue.

All items exposed to the open-air-storage environment were retired after two and one-half years of test. All 'domestic treatment' items in this environment were in various stages of deterioration; each required some rehabilitation. Although the normal cycle for 'contact preserved' equipment had expired, the items were still in usable condition in many instances, and could have remained longer without re-preservation; some items required overhaul before reissuing.

Comparison of Charts 1 and 2 indicates a definite average increase in resistance to rusting when an item is given contact preservation, but this does not assure that the specimen is immune to damaging amounts of rust. Furthermore, for Item 6, the results of contact preservation were erratic compared to 'domestic treatment'; for Items 3 and 4, the added resistance to rusting was rather limited in open and shed storage. There is a marked and more dependable improvement in storage life as the storage environment is improved. Although shed storage did not yield the anticipated improvement over open storage, normal warehouse storage yielded a marked improvement.

No rusting occurred on critical areas of items stored in either controlled humidity warehouse. Some items prepared for the controlled humidity environmental test rusted when temporarily stored in a shed. Subsequent storage in the controlled humidity warehouse arrested the progress of this rusting and no new spots developed.

Although the economic analysis is not complete at the present time, the test demonstrates the efficacy of controlled humidity storage in preventing rust and corrosion. Preliminary computations, accounting for all factors contributing to cost under the five different environments, indicate the economic advisability of storage for the 'domestic treatment' or 'contact preserved' items under environments of 40 to 50% RH.

Deterioration Curves for Contact Preserved Items showing total accumulated rust areas in each environment and the length of storage time beyond which certain items were no longer in a "satisfactory-for-issue" condition.

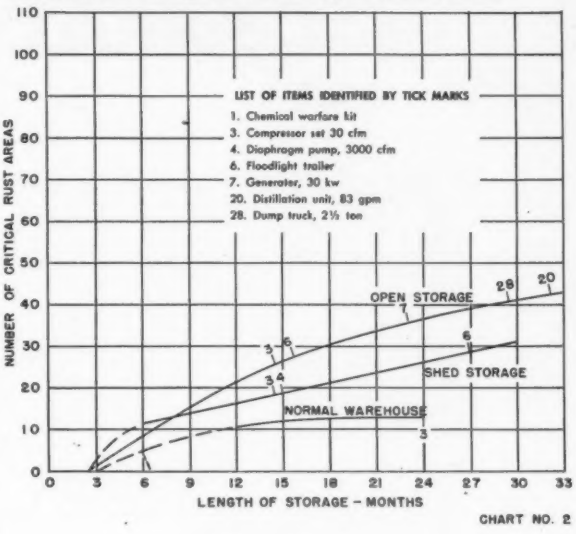
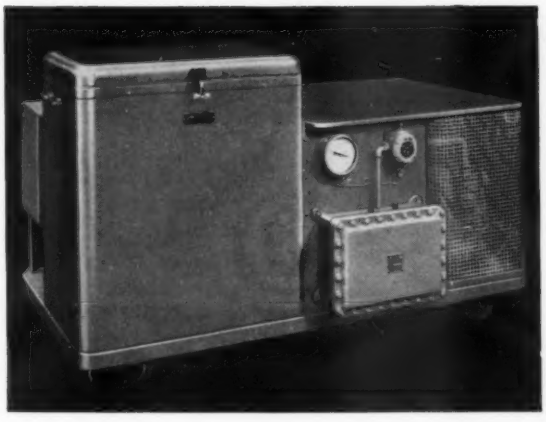

NUMBER OF CRITICAL RUST AREAS
LENGTH OF STORAGE – MONTHS
LIST OF ITEMS IDENTIFIED BY TICK MARKS
1. Chemical warfare kit
3. Compressor set 30 cfm
4. Diaphragm pump, 3000 cfm
6. Floodlight trailer
7. Generator, 30 kw
20. Distillation unit, 83 gpm
28. Dump truck, 2½ ton
OPEN STORAGE
SHED STORAGE
NORMAL WAREHOUSE
CHART NO. 2

Chart No. 2



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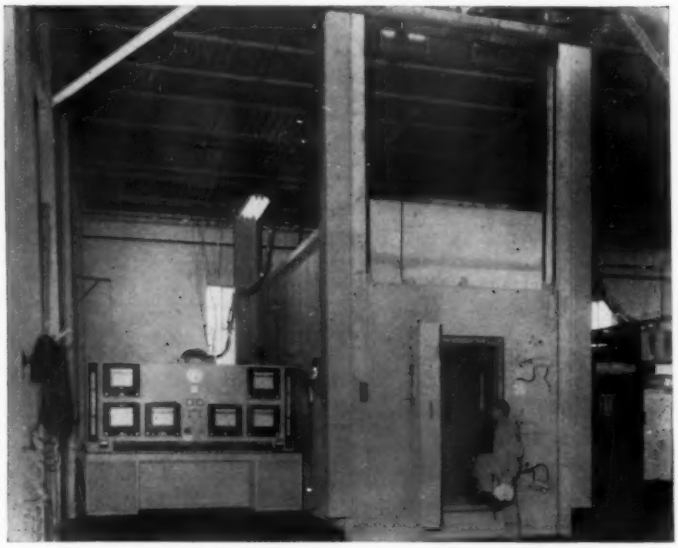
CONRAD Field Offices



1200 CU. FT. WALK-IN. This C chamber is sectionalized to permit te at high and low temperatures simu eously. Range: —120°F. to +6 altitudes in excess of 125,000 ft. Ca of dissipating 40,000 watts at —1 Complete unit is prefabricated in sections—main chamber, machinery, instrument panel. Main chamber co of two chambers with port in separ wall. In typical test, missile compo is installed in port which is then s so high and low temperatures ma applied to different sections of compo simultaneously.

MOBILE-TEMPERATURE UNIT. Conrad ingenuity designed this mobile unit to supply conditioned air. Range, —100°F. to +300°F. Supplies conditioned air, by self-contained pressure blower, for testing missile or other object in a separate chamber or temporary housing. Connects to facilities power source or portable power generator truck. Model illustrated is equipped with a 50 h.p. refrigeration system: other sizes available according to requirements. Iconel sheathed electric heaters handle rapid changes in high temperature demands.

CONRAD Inc.

HOLLAND, MICH.

Subsidiary, Crampton Mfg. Co.

ENVIRONMENTAL TEST CHAMBERS FOR ALL APPLICATIONS

ghout The U.S. to Serve You

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CONN.:	**KENT** R. M. Alden Box 278 WAlker 7-3319	OHIO:	**TOLEDO** M. Denver Armstrong P.O. Box 294
FLA.:	**CLEARWATER** W. Ben Wimberley Co. 532 S. Ft. Harrison Ave., 3-7072	TEXAS:	**DALLAS** W. N. Wright 5738 N. Central Expressway TAylor 4-2571
FLA.:	**ORLANDO** W. Ben Wimberley Co. GArden 5-3083	TEXAS:	**HOUSTON** N. Gene Simpson 1803 Calumet St. JAckson 3-5651
GA.:	**ATLANTA** Ben T. Schladenhauffen J. J. Grim 3230 Peachtree Rd., N.E. CEdar 3-5519	UTAH:	**SALT LAKE CITY** Vernon Parrish 1810 S. St. Paul Denver, Colo. SKyline 6-6884
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FREE! New chart of technical information and conversion data. Address your request to your nearest Conrad field office.

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Among the many firms throughout the United States and Canada where Conrad environmental test chambers are installed are the following:

rt Instrument Co.
eneral Electric Co.
rma Bosch
ytheon
e Martin Co.
ace Technology Laboratories
mo-Woolridge Corp.
ughes Aircraft Corp.
rth American Aviation
ouglas Aircraft
innеapolis Honeywell
rthrup Aircraft
ndia Corp.
erry Rand Corp.
t Propulsion Laboratories

Right: Portable vibration-temperature chamber, with hydraulic hoist.

Below: Conrad's long experience assures accuracy in production techniques. These are Conrad FB-64 and FD-64 models, with 4' x 4' x 4' test space and temperature ranges from —100° to +300°.

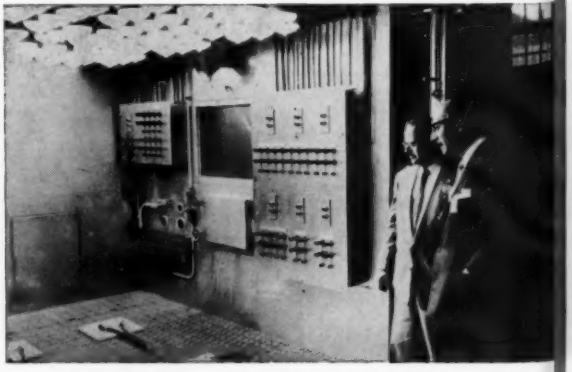
Environmental Quarterly's Album of People,

EARTHBOUND NO MORE but still a fledgling, North American Aviation's X-15 rose to 38,000 feet on March 10 safely coupled to the underside of the right wing of an eight-jet B-52. Free gliding is the next step in the test program for the half-plane, half-rocket designed to carry a man into space.

RECORDING ENVIRONMENTS. Above, a Martin Company engineer gets a record of microscope creep-strain tests at elevated temperatures with a 16 mm. camera setup. At right is the auto-optic recording pyrometer developed by Avco Research and Advanced Development to measure surface temperatures ranging from 1400 to 3000° C.

GLEAMING ATLAS MISSILES, each 10 feet in diameter and 75 feet long, are shown in this first photo of their production line released by Convair, San Diego. (See Page 6.)

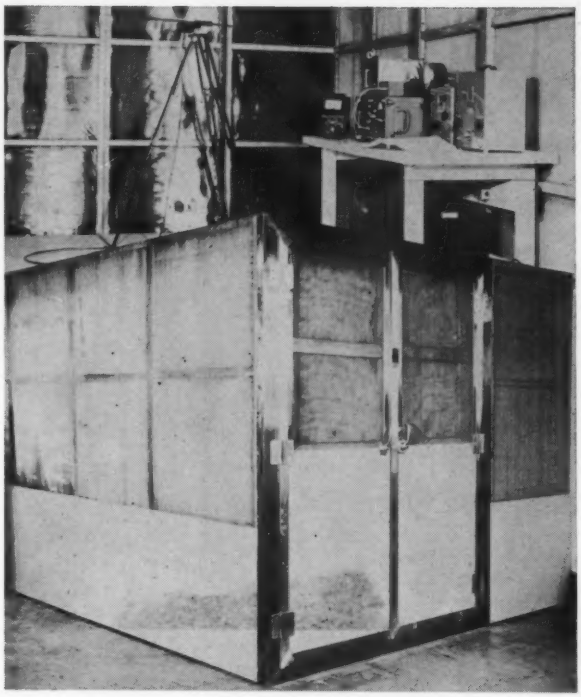
EVEN THE DROPLETS are like nature's—random size—in Frankford Arsenal, Philadelphia's, rain and sunshine chamber. Precipitation can be controlled at the rate of a half-inch to 24 inches an hour, with various water and air temperatures and wind velocity . . .



. . . but there's sun in the eyes of Monroe Seligma (right) and David Askin, chief of Frankford's enviro mental branch, during a test on power cables. M Seligman heads Tenney Engineering, Inc., which mad the Frankford chamber.

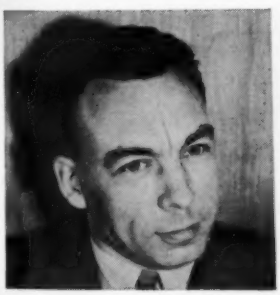
Products, Places and Ideas . . .

ONLY NON-CORROSIVE MATERIALS went into the walk-in cabinet (above) engineered by Hudson Bay Co. for the Bendix Corporation. (For more info circle EQ RSC #43.)



EXPANSION AT ACTON LABORATORIES includes the complete radio interference testing facility shown at right. (For more info circle EQ RSC #44.)

— • —



KARL UNHOLTZ (left) and JOHN A. DICKIE
Principals in New Vibration Engineering Service Firm
(See Page 31)

MARVIN WENTWORTH
Western Sales Chief
(See Page 28)

ROLLAND S. JAMISON
Sales Manager
(See Page 28)

MAKER OF THE GIANT SHAKER pictured above is Ling Electronics, Inc. The company calls it the "highest powered electronic vibration system produced to date." The shaker in the foreground has full frequency output of 25,000 pounds force. In the background is part of the system's 175,000 VA power generator. (See Page 30. For more info circle EQ RSC #45.)

LABLINE-HUDSON BAY

ENVIRON-CABS

provide most exacting temperature and humidity conditions for testing materials and components

No. 3960A—10 cubic feet

Built to duplicate a wide range of environmental conditions. 4 sizes—2 models, or custom-built to your requirements. Table models to Walk-in sizes available. Write for full information.

HUDSON BAY CO.
Pioneers in environmental cabinets
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See the most modern line of environmental cabinets
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Hudson Bay Co.
Environmental division of Lablinc, Inc.

Post Scripts

(Continued from Page 3)

ronmental Business" on Page 30. To Quarterly's knowledge, it was the first such public survey ever conducted in the industry. We plan others from time to time. If you have any questions to suggest, send them along for our consideration.

Idea Swap Shop

One of the most valuable services **Environmental Quarterly** can render is to act as a clearing house for information.

Any magazine is, of course, loaded down with ideas, but mostly these are offered by editors and advertisers anticipating reader interest. Several factors tend to dilute even the best of such efforts, and space is one such factor. The institution known as the "reader's service card" has grown up in an effort to overcome lack of space. RSCs began flowing back a few days after the last issue of **Environmental Quarterly** hit the mails, and we're still getting a few from that issue. A new RSC is bound into this issue. It's for your convenience and benefit.

Among the inquiries were a number we were unable to direct to a specific source for a reply. These questions are reproduced below in the hope that readers may be able to supply the answers.

We'd like to make an "Idea Swap Shop" a regular feature of **Environmental Quarterly.** Address your problems—or replies to questions posed herein—to "Idea Swap Shop," Environmental Quarterly, P. O. Box 2583, Grand Central Station, New York 17, N. Y.

Here are the pending requests:

FML would like "any other lead you might have on vibration analysis."

SEA asks for "anything on operational amplifiers."

EO is interested in a "vibration system—frequency 5 to 2,000 cps, both sine wave and complex motion. Specimen weight, 375#, vector force 20,000#."

NEWS BRIEFS

WASHINGTON — An extra firi stage that could mean use of the At missile for shots to Mars and Venus l been ordered by the Air Force. A c tract that could amount to seven mill dollars in the first year is involved, cording to Convair-Astronautics.

• • •

DAYTONA BEACH — David Young, coordinator of space science a technology for the Advanced Resea Projects Agency, told the Americ Rocket Society that 400 million doll and a "sympathetic approach" by government could give the United Sta a manned space ship in three years.

• • •

WASHINGTON—The National A onautics and Space Administration nounced that it is developing "a p man's rocket" for space launchings. be known as the Scout, the rocket cost less than half a million dollars. will be a four-stage solid-fuel roc weighing 35,000 pounds and is expec to be ready for testing by the middle next year. Ballistic missiles cost a mill dollars or more.

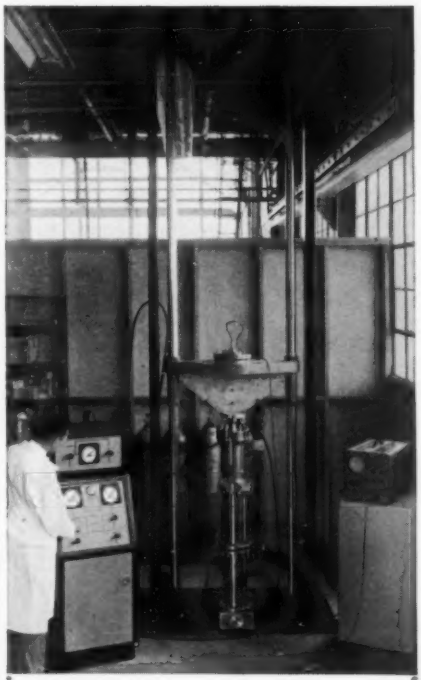
WRM suggests "articles covering transmissibility test plans, specification or vibration environment for missiles." (Send us a brief summary if you have any thoughts on such an article.)

Now a Favor, Please

One of the big chores in taking over publication of **Environmental Quarterly** has been that of whipping the list of readers into shape. Persons change addresses, new readers join us and, yes, we've even had a dropout—a reader who wrote that he is no longer working in the environmental field. We think the list is up to snuff for this second quarterly issue, but if any errors remain please let us know and we'll correct them.

Incidently, even though **Environmental Quarterly's** readership is the broadest in the field, we'd like to reach those potential readers who may not have met us. If you know of any such person, won't you oblige by jotting down his name on the reply card provided for the purpose. We'd like to send him a sample copy.

Only HYGE can produce and repeat so many different kinds of shock



60-second test simulates exact service conditions, records shock waves on oscilloscope for instant reference or photographic record.

What shock situation would you like to set up? Shock loads to missile launcher? Re-entry—to atmosphere, land or water? Rocket fuel handling? Parachute landing? Underwater or underground explosion? You can simulate them all with HYGE . . . and repeat each one exactly . . . for only pennies per test. And as new test requirements develop, an inexpensive metering pin adapts HYGE to meet them. You have a permanent source of stored energy—variable, to meet your needs, up to 40,000 lbs. thrust—with versatility for a wider range of shock wave patterns than with any other equipment. If shock is a factor in the success of your project, you'll want to know more about HYGE.

Write for Bulletin 4-70 . . . theory, application and specification data on HYGE Shock Testers.

Consolidated Electrodynamics

Rochester Division, Rochester 3, N.Y.

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES

LITERATURE FOR ENVIRONMENT...

Conrad Inc., manufacturer of environmental test equipment, is distributing a handy, wallet-size ARDC Model Atmosphere Chart free of charge. It shows altitude in 1,000-ft. increments to 1.8 million feet, with corresponding temperatures and pressures, and includes such valuable data as vacuum equivalents. **(Circle EQ RSC #25.)**

* * *

New York Testing Laboratories, Inc., which tested the engines on the "Spirit of St. Louis," has issued a brochure describing its facilities as a completely integrated independent commercial testing laboratory. The two-color, six-page publication also lists the more common military and government specifications it is certified to perform. **(Circle EQ RSC #26.)**

* * *

Blue M Electric Co. describes its "Power-o-matic" control system in Bulletin 1950. The system is incorporated into the firm's environmental cabinets, convection ovens and other products. **(Circle EQ RSC #27.)** Companion Bulletin 1951 illustrates temperature control equipment featuring "Power-o-matic." **(Circle EQ RSC #28.)**

* * *

Decision Inc.'s 1959 Engineers' Job Directory, with information on 1,000 top companies, is now on sale at $5 a copy. The 72-page placement guide may be obtained by writing Decision/Inc. at 4601 Red Bank Rd., Cincinnati 27, Ohio.

The Bristol Company has released a new edition of its Bulletin P1245-A, Dynamaster Electronic Instruments. Included in the 64-page bulletin are specifications of the company's potentiometer and bridge instruments and details on the incorporation of Dynamaster instruments into other manufacturers' equipment. **(Circle EQ RSC # 29.)**

* * *

B & K Instruments, Inc. is distributing two of its "Bruel & Kjaer Technical Review" articles. These are illustrated pamphlets dealing with the damping effect of surface coating material for reducing noise and vibration. **(Circle EQ RSC #30.)**

* * *

"AEC Research Reports Price List No. 31," a cumulative listing of some 4,000 unclassified documents are available free from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. A monthly periodical which lists reports of various U. S. agencies as soon as they are released, "U. S. Government Research Reports," may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at $6 a year.

* * *

BJ Electronics, Borg-Warner Corp. has issued three bulletins to describe its Model DP-7 pressure transducer, Model GP-15D high range pressure transducer and Model DP-15D high range differential pressure transducer. The bulletins also give application information. **(Circle EQ RSC #31.)**

Dow Corning Corp. tells in a brochure how Dow Corning 5 Compound curtails arcs, shorts and the formation of leakage paths on insulators exposed to contaminated atmospheres. **(Circle EQ RSC #32.)**

* * *

Reynolds Metals Company has compiled latest information on the soldering of aluminum in a 22-page booklet with many diagrammatic illustrations. **(Circle EQ RSC #33.)**

* * *

Fischer & Porter Co. has published five new spec sheets on pressure instruments with corrosion-proof fiber glass cases for indicating, recording, controlling and transmitting applications. **(Circle EQ RSC #34.)**

* * *

Syntron Company has a new catalog section on mechanical seals designed to stop leakage of gas and liquids from around the rotating shafts of pumps, compressors and mixers. **(Circle EQ RSC #35.)**

* * *

ITEMCO, Inc's TempLine series of chambers and chests are illustrated in a new, three-color folder. **(Circle EQ RSC #36.)**

* * *

Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., has placed on sale at $3 a 161-page publication, PB 151277, "Historical Survey of Inhabitable Artificial Atmospheres," a bibliography with 400 annotated references.

HARRIS 2-CHAMBER UNIT GIVES DOUBLE TEST CAPACITY— HIGH OR LOW TEMPERATURE OR BOTH

Harris ingenuity, traditional since 1934, is exemplified in this double chamber environmental testing unit. The two chambers are completely separate and independently controlled, though chilled by a single refrigeration machine. Both provide complete temperature range from —125° F. to +250° F. Both may be operated simultaneously at either temperature extreme, or one may be set for low temperature and the other for high temperature testing. This exceptional versatility at least doubles the unit's capacity since two separate tests may be run at the same time. In use by several major electronic manufacturers, it has proved dependable, effective, and highly economical for production testing.

SPECIFICATIONS: Outside dimensions — 74" long x 36" deep x 76" high. Net free working area in each chamber — 24" x 24" x 24" (8 cu. ft.). Temperature range: —125° F. to +250° F.

Harris Model 2-8EL-AU2 2-chamber hi-lo temperature testing unit

HARRIS REFRIGERATION CO.

308 RIVER ST.
CAMBRIDGE 39, MASS.

Environmental testing equipment for every requirement, standard or custom models. Write for our advice. There's no obligation

Government Publications

Almost every day the U. S. Department of Commerce releases a number of technical reports for the use of industry. These documents are sold through the department's Office of Technical Services, Washington 25, D.C. Some recent releases are:

"Investigation of a Method for the Measurement of Subsonic Oscillatory Aerodynamic Influence Coefficients," by H. N. Abramson and P. A. Beckman, Jr., of the Southwest Research Institute for Wright Air Development Center. Wind tunnel tests were conducted and the experimental method developed was found to be feasible. 76 pages. Order No. PB 131819, $2.

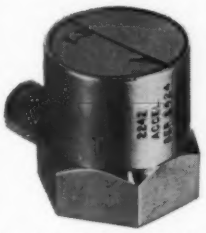
"Mean Monthly 300 and 200-MB Contours and 500, 300 and 200-MB Temperatures for the Northern Hemisphere," by E. W. Wahl, Air Research and Development Comand. Included are mean monthly contour and temperature charts, said to be the first attempt to represent the large scale features of temperature and pressure height distribution of the upper troposphere and their changes in the course of a year. 90 pages. Order No. PB 131979, $2.25.

"Development of Brazed Sandwich Construction Materials for High Temperature Applications," by C. F. Burrows and F. J. Ragland, Jr., of The Martin Company, for Wright Air Development Center. The successful base-braze metal combination, Type A-286 steel, an austenitic super alloy containing titanium and aluminum, brazed with a nickel-chromium-silicon-iron-boron alloy, showed excellent structural and fatigue properties at operation temperatures from 1000 to 12000° F. 105 pages. Order No. PB 151272, $2.50.

"A Vibration Manual for Engineers (Second Edition)," by R. T. McGoldrick, Structural Mechanics Division, David Taylor Model Basin, U. S. Navy. The manual contains formulas useful to design engineers in minimizing vibration difficulties and is designed to expedite calculations required by practicing engineers. 32 pages. Order No. PB 131785, $1.

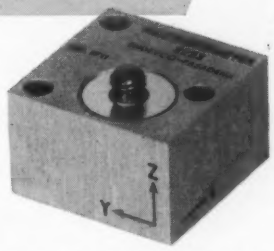
"Evaluation of Effect of Paint on Absorption Coefficient of Acoustically Treated Surfaces," by M. Rosenfeld, Material Laboratory, New York Naval Shipyard. Paint coatings as thick as .005-inch were found to have no significant effect on sound-absorption capabilities of two types of perforated sound-proofed panels. 12 pages. Order No. PB 131836, 50 cents.

measure vibration ...at 500°F without cooling or correction
...in 160 db high intensity noise fields



MODEL 2242 ACCELEROMETER
(actual size)

ENDEVCO
accelerometers



MODEL 2223 TRI-AXIAL ACCELEROMETER
(actual size)

Endevco Accelerometers, employing Piezite® Element Type II, measure vibrations and shock from −100°F to +500°F without correction. The wide frequency range (2 cps to 10 KC) remains unchanged by temperature extremes. Complete cable and cathode follower systems to withstand 500°F are part of the many accessories for making up Endevco systems for flight and laboratory use.

Endevco isolated compression accelerometer systems effectively measure 10 g of vibration in a 160 db noise field with signal/noise ratio of 20 to 1. These integral accelerometer-amplifier packages have a temperature range from −65°F to +250°F, are hermetically sealed, eliminate cable noise and are designed for use where remote location of the amplifier is not necessary.

MODEL 2806 ACCELEROMETER SYSTEM

Information on Endevco dynamic measuring instruments is contained in a new, illustrated "Engineering Manual, Series 2200, Accelerometers." Included are general descriptions, specifications, performance data under environmental extremes, calibration procedure, maintenance and prices of the many types of Endevco accelerometers, pressure pickups and accessories. Mail coupon today for your copy. Better still, tell us your specific problem. Chances are we can be of help.

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Please mail me a copy of "Accelerometer Engineering Manual, Series 2200." Thank you.

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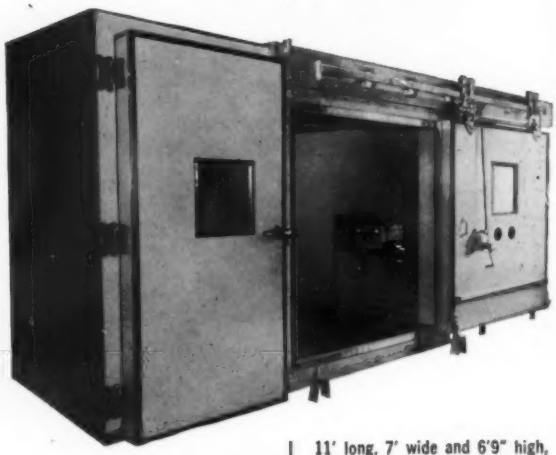
today's testing... | tomorrow's product...



ENVIRONMENTAL WALK-IN CHAMBER

11' long, 7' wide and 6'9" high, with 6'6" door opening. Temperature range −90° to +250°F. For Humidity Cycling, Rain Tests, Freezing Rain, Sand and Dust Tests, etc.

■Whether it's for chemical, technical or engineering tests...whether it's for the very smallest commercial electronic component to the very largest military missile...you'll find the experienced research department and staff *you* want at New York Testing Labs. You'll find all the facilities needed to carry out Certified Qualification Tests (to all phases of MIL E 5272A), and you'll find complete chemical, engineering and research laboratories geared to make the most accurate tests and evaluations ever offered under one roof! For over 40 years, New York Testing Laboratories, Inc. has set a standard for accuracy and quality...why not find out more today?

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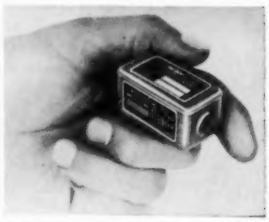
NEW YORK TESTING LABORATORIES, INC.

47-48 WEST STREET, NEW YORK 6, N.Y.
BOWLING GREEN 9-6220

NEW PRODUCTS...

A "Reader Service Card" requiring no postage is bound into this issue for the convenience of those desiring additional information on new products, new literature (Page 22) and other announcements. It is keyed in the text as "EQ RSC.")



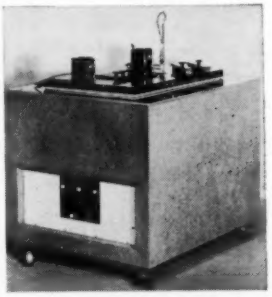
Miniature accelerometer, 1x1x1¾", weighing three ounces and using a potentiometer-type pickoff, developed by **Genisco, Inc.** This model, GMA, is designed particularly for aircraft and missile fire and flight control systems and telemetering applications. Range is ±.5g to ±100g's with natural frequencies of from 12 to 75 cps. Linearity is ±1% of full scale for balanced range instruments. Damping, nominally .7 of critical at +75°F, is provided by shearing silicone fluid between closely spaced moving surfaces. Instrument is temperature compensated and will operate to specifications between -20°F and +250°F. Ability to withstand vibrational accelerations of 10g's, 10 to 20,000 cps, on any axis and shock accelerations of 50g's for 7 ms duration on any axis is claimed.

For More Information Circle EQ RSC #1

Vertical hot-cold-humidity chambers, using dry ice refrigerant, by **Development Engineering Co., Inc.,** enable operator to stand without leaning over to work in a deep chamber and are said to conserve floor space. Chambers have range from -90° to +240°F and can go to 425° F. Humidity ranges from 20 to 95%. Other features: separate compartment for dry ice, interior chamber fan to insure even temperature, circulating fan, adjustable dry and wet bulb thermostats, and two-heat control. Available with 6-pane windows, 3" ports and electrical and hydraulic penetrations.

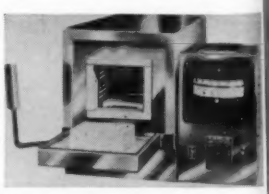
For More Information Circle EQ RSC #2

Variable temperature baths to test diodes, electronic components, thermostats, and other equipment, by **Labline, Inc.** Mechanically unbreakable thermistor controls maintain temperatures within ±.1°C accuracy. "Produc-temp Baths" are available as individual units adjustable to 100°, 25°, or -55°C. Also come as combination bath with temperature range from 100° to -55°C. All units have stainless steel interiors, cold-rolled steel exteriors and recessed panels, 2-1/30th H.P. circulators. Overall dimensions: 46x36x38". Combination units have 1 H.P. agitator motors circulating 150 gallons a minute.



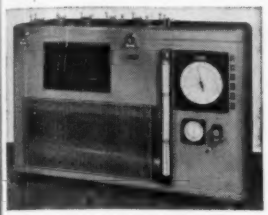
For More Information Circle EQ RSC #3

"Lab-heat" muffle furnaces by Blue M Electric Co. with automatic electronic indicator-controller. ±1% accuracy of indication. Setting of index pointer permits selection of temperatures, and uniform, set temperature is maintained automatically. Power selector switch for control of wattage for low, medium, high temperatures. Modella heating elements. Ribbed, extra-thick element plates. 2½" thick firebrick insulation all 6 sides. Two models available.



For More Information Circle EQ RSC #4

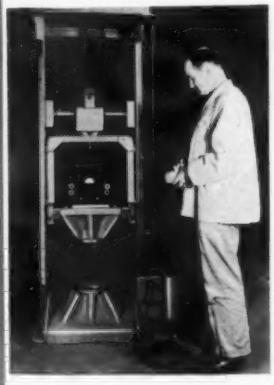
Compact test chamber for altitudes up to 80,000 ft. and temperatures from -70° to +260°F, by **Cincinnati Sub-Zero Products.** Model ASV-70-10-HC, with chamber 48x20x18". Controller (dry-bulb) is Brown 152C33PS-24W7-11 recording controlling potentiometer. Has HG-98A6 Flexopulse timer, 110-V control circuit, plus air circulator and terminal panel. Uses F-22, F-13 (Cascade system) refrigerants. Outside dimensions 56x84x38". Has four swivel casters, with window and interior lights.



For More Information Circle EQ RSC #5

Miniaturized "Vibramite" vibration pickup, Type 11 by **MB Manufacturing Co.** is 1.42" square, 1" high, weighs 2.75 oz. for minimum effect on test specimen. Has Eddy current damping, with 96.3 mv/in./sec sensitivity, and response range from flat 40 to 2000 cps ±5%, 30 to 2000 cps ±10%. Acceleration limit is 50g guaranteed, with temperature of -85°F to +500°F (continuous with minimal effect on sensitivity).

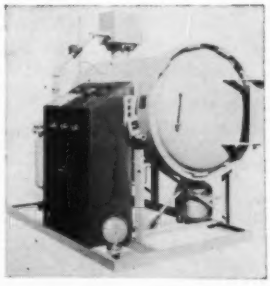
For More Information Circle EQ RSC #6



"Varipulse" shock machine by **Barry Controls, Inc.,** complies with pulse-defining specifications. Units, in specimen capacities of 100 and 400 lbs., permit independent variation of pulse with respect to its configuration, peak acceleration and duration. Uses free-fall drop principle to impart initial velocity to test platform, with deceleration precisely controlled by impact media. Offers high order of repeatability. Uses 100 v. power for hoist and release. Type 15575 accommodates test specimens up to 100 lbs., measuring 15x15x15".

For More Information Circle EQ RSC #7

Explosion test chamber featuring simplified fuel measuring system by **Missimers, Inc.** For tests under MIL-E-5272A and MIL-E-005272B for items which must operate in explosive atmosphere, and for testing explosion-proof enclosures. Chamber meets ASME pressure vessel code requirements and can simulate altitudes up to 85,000 feet with or without explosion tests. Safety features include quick-acting doors, interlock switches and relief valves. Chamber uses commercial butane or aviation gasoline as fuel and is adaptable to other fuels. Blower system for rapidly diffusing fuel vapor, auxiliary sampling chamber, temperature control to 160°F and access for instrumentation leads are other features.



For More Information Circle EQ RSC #8

(Continued on Page 27)

Environmentalists

PROVE PRODUCT RELIABILITY under all environmental conditions. Equipment Sales represents a complete line of environmental test systems to meet commercial and military spcs. Write for free comprehensive bulletin.

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shock-acoustic noise	Lycoming
temp. alt. humidity	Intl. Radiant Corp.
acceleration (centrifugal)	Amer. Mach. & Fndry.
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IN THE TWINKLING—From a standstill to 18 Gs in .04 of a second—count 'em, .04 of a second—is the kind of punishment Lockheed's "G-Shooter" metes out. The rocket travels only two feet in the process.

Creating Super Get-Up, Super Go, Super Heat

From a dead stop, the Lockheed X-7 missile surges forward at an acceleration that would crush your body under two tons of weight, hits top speed, then slams to a stop—like hitting a solid brick wall head-on at 60 mph.

That's the kind of acceleration simulation achieved by Lockheed Missile Systems division's "G-Shooter"—in only .04 of a second and a distance of two feet.

The G-Shooter is in operation at the Lockheed test center at Holloman Air Force Base in New Mexico. It was especially designed to give engineers a realistic look at how instruments in the missile withstand the shock of the rocket boost that brings the X-7 to a speed where its ramjet engine takes over.

The X-7 is used to test ramjets for the Air Force. Although it is claimed to be the fastest and highest flying air-breathing missile in the free world, details of its performance are still classified.

To conduct the rugged test that achieves 18 Gs, the X-7 is mounted on rails, and a pressure of 2,100 pounds per square inch is built up in a cylinder containing a piston. With a deafening roar, the pressure lets go, the piston flashes forward and the missile blasts off on its two-foo trip along the rails.

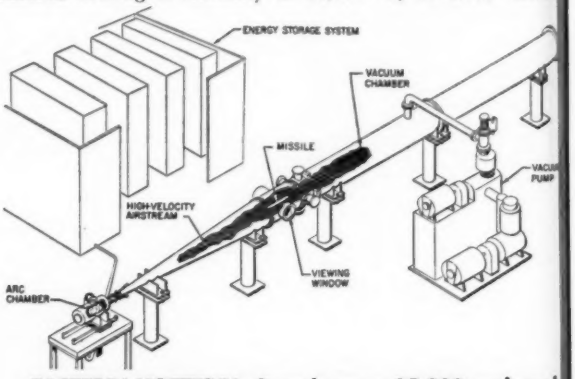
Eight bands of nylon webbing strung under the rails ac as brakes and keep the bird from flying off the shooter a it hits a speed of 23 feet per second in only six inches. Fou of the webs stretch to their limit to absorb the tremendou shock, then snap as planned to prevent rebound. The othe four are there for safety.

In a "hot" shoot all of the missile's electronic systems ar operating and sending out radio signals to nearby monito consoles. When the systems are not running, the shoot i a "cold" one.

At Palo Alto, Calif., Lockheed has come up with anothe unusual environmental testing device, a wind tunnel wit speeds up to 15,000 mph and temperatures said to b 6,000 degrees hotter than the sun's surface. The only tw other tunnels like it in the free world are at the Air Forc installation at Tullahoma, Tenn.

Designed especially for Polaris missile testing, the ne Lockheed tunnel has a chamber two feet in diameter an is 44 feet long and six feet high.

A 20-million kw jolt of electricity is required to fire small chamber of highly compressed air at one end of th tunnel, heating it instantly to 18,000° F, or 6.000° hotte



FASTER'N HOTTER'N—Speeds up to 15,000 mph and temps higher than sun's surface are specified for Lockheed's "hotshot" wind tunnel.

than the sun's surface. To keep the tunnel itself from mel ing under the temperature, firing time is limited to 1/25t of a second.

The superheated air then explodes through a diaphrag and down the evacuated section of the tunnel, taking thousandth of a second to reach the missile's nose cone.

To spark the "hotshot," 320 condenser units are packe into a room 24 feet square. When the current is triggere through the arc chamber of the tunnel, pressures of 30,00 pounds per square inch are built up to move the supe heated air.

ENVIRONMENTAL TESTING

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An independent testing laboratory with complete facilities for testing your products to requirements of Government and Industrial Specifications.

- Vibration
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- Fungus Resistance
- Radio Interference

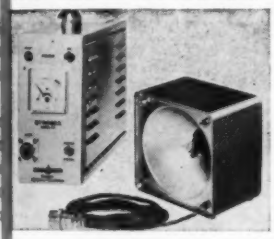
LAMBERT ENGINEERING COMPANY
Research & Testing Laboratory
1100 Macklind Ave. St. Louis 10, Mo.
Phone: MIssion 7-3488

New Products (Continued from Page 25)

Miniature scale mechical convection oven with Pow-r-O-Matic control system, by **Blue M Electric Co.** Measures 5 x 4½ x 5" on inside. System automatically proportions minimum wattage relative to operating temperatures and work load and is said to provide closer, more uniform temperatures throughout larger working volume. Actual control point within ±½° C. throughout entire range to 600°F.

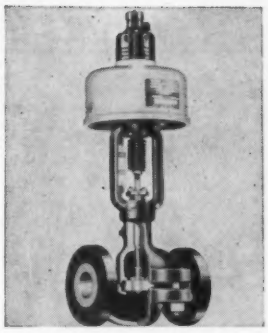
For More Information Circle EQ RSC #9

Compact stroboscope, available from **Chadwick-Helmuth Co.,** for continuous slow-motion observation and photography of vibrating or rotating specimens. Also can serve as "shutter" and light source for multiple exposure photography of drop tests and in photography and viewing of specimens during acceleration test on a centrifuge. Strobex Model 121 consists of heavy-duty power supply, and 2-lb. lamp assembly, hand-held or tripod mounted. Forced-air cooling for flash tube. Features include light output of 10-candle-sec/flash up to 100 flashes/sec, broad illumination angle of 50° and easily-replaced, low-cost motion viewing and photography from 5 cps to 10 KC. Strobe may be triggered by external contactor for synch to specimen or camera, and by audio oscillators or calibrated strobes for speed measurement. flash tube. Unit suits slow-



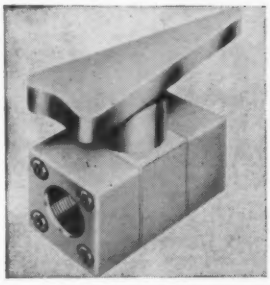
For More Information Circle EQ RSC #10

Split-body control valves for high-temperature, high-pressure control applications, by **Kieley & Mueller, Inc.** Features claimed are large-flow capacities and face-to-face dimensions based on I.S.A. standards. Valves are fully interchangeable with maker's globe-body diphragm valves, plus other standard makes. All major components (topworks, valve bodies, line flanges, plug and seat rings) are unitized, permitting 432 valve combinations from one split-body to minimize user's plant inventories.



For More Information Circle EQ RSC #11

Flow-ball plug valve (3000 psi) with zero leakage and one-quarter-turn positive opening and shut-off, by **Hydromatics, Inc.,** makers of such valves for astronautics, aeronautics and cryogenic applications. In non-throttling uses, Flo-Ball replaces conventional needle valve. It completes the positive open and shut-off cycle in a 90° arc of travel. Valve handle responds to finger-tip pressure. Designed for panel, bracket or line mounting, the valve takes varied end fittings. Can be used for gauge shut-off and with corrosive or other hard-to-handle fluids.

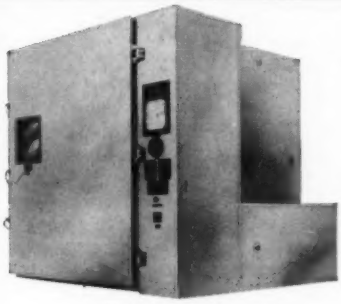


For More Information Circle EQ RSC #12

(Continued on Page 29)

CREATING ENVIRONMENT...

DEVELCO



WALK-IN SALT SPRAY

Designed to meet various government specifications, DEVELCO chambers will hold environmental conditions to close tolerances, are easy to operate and maintain.

TOP-OPENING SALT SPRAY

DRY-ICE CHAMBER

DEVELOPMENT ENGINEERING COMPANY INC.

9 Cross Street Norwalk Connecticut

Salt Spray — Hot-Cold — Humidity — Altitude — Explosion — Fungus

People You Know...

CHANGING ENVIRONMENTS

ROLLAND S. JAMISON, who has been administering a national marketing program for HARRIS REFRIGERATION CO.'s low temperature refrigeration equipment, has been appointed sales manager by the Cambridge, Mass. firm. An authority on low temperature refrigeration, he was assistant to the president of Cincinnati Sub-Zero Products before joining Harris. (See EQ's Album, Page 19.)

* * *

MARVIN WENTWORTH and **ERNEST E. THORNTON** have new posts at LING ELECTRONICS, INC., of Culver City, Calif. Mr. Wentworth, who directed engineering operations for a big West Coast tv station before joining Ling two years ago, has been placed in charge of vibration system sales in the 11 Western states. (See EQ's Album, Page 19.) Mr. Thornton has been appointed sales engineer for the same territory in a Ling program of increased emphasis on sales-service facilities. He came to Ling a year ago via Northrop Aircraft and The Garrett Corporation's Airsupply Company.

* * *

PALMER CLINGMAN has joined the sales engineering staff of DEVELOPMENT ENGINEERING CO., INC., Norwalk, Conn. He came to the manufacturer of "DEVELCO" environmental equipment from a major lab, where he was a test engineer.

* * *

WALTER GOTTESMAN and **RAYMOND STACKHOUSE** have been advanced in executive posts at TENNEY ENGINEERING, INC., Union, N. J., manufacturer of environmental test equipment and refrigeration and heat transfer units. With Tenney since 1952, Mr. Gottesman is now assistant secretary. Mr. Stackhouse, controller of the company, has been elected assistant treasurer. He joined Tenney in 1937.

* * *

JAMES R. IRVING has been appointed executive secretary of the laboratory equipment section of the SCIENTIFIC APPARATUS MAKERS ASSOCIATION, and **RICHARD D. HANNAN** has been named executive secretary of SAMA's industrial instrument section.

* * *

HARRY E. BEANE, JR. is the new sales engineer in the Albany-Syracuse, N. Y., area for THE BRISTOL COMPANY, Waterbury, Conn., instrument manufacturer. He was with Kieley and Mueller until 1956.

* * *

DR. GEORGE D. SANDS, formerly chief of the Nuclear Branch of the Army Transportation Research and Engineering Command, has joined THE MARTIN COMPANY, Baltimore, as director of scientific requirements, a new corporate post. At the same company, **DR. CLARE P. STANFORD** has become chief of the engineering department.

Ernest E. Thornton

Walter Gottesman

Raymond Stackhouse

* * *

JAMES H. MARKS, Detroit management consultant, has been named chairman of the committee on membership at-large of SIGMA XI. He has been a member of this honorary scientific society for 50 years.

* * *

DR. C. E. OELKER is the new director of engineering for the Cincinnati division of BENDIX AVIATION CORPORATION. He was formerly with Avco Manufacturing's Crosley division and with GE.

* * *

AUGUST C. ESENWEIN, vice president and general manager of CONVAIR's Fort Worth plant, has become executive vice president of the General Dynamics Corporation's division. He has been succeeded in Fort Worth by **FRANK W. DAVIS.**

* * *

RICHARD T. MCCAULEY has been appointed general sales manager of KOEHLER AIRCRAFT PRODUCTS COMPANY, Inc., of Dayton, Ohio. He was formerly executive assistant to the president.

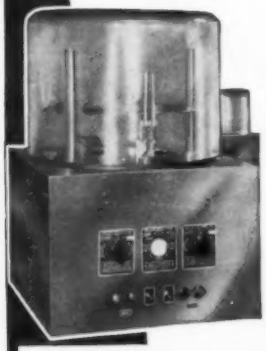
* * *

DONALD E. SMILEY is the new president of PICO PRECISION PRODUCTS COMPANY, Pico, Calif, manufacturer of specialized tooling, testing equipment and machine parts for electronics, missile and aircraft industries.

THE REVOLUTIONARY NEW LOW-COST

vapor-temp

CONTROLLED HUMIDITY CABINET



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DRY BULB:
Ambient to 156° F. within ± 1° F.

Compact, Complete, fully automatic Controlled R.H. offered at low cost. Inverted Pyrex Jar (16"Dx12"H used as work chamber) placed on Stainless Steel Cabinet housing Controls, Motor and Blower. Guaranteed accurate and stable controlled humidity.

MECHANICAL
ANNULAR AIR FLOW
FULL ACCESSIBILITY
FULL VISIBILITY

IDEAL FOR MANY MIL, JAN, AND ASTM TESTS

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Viewing glass units for environmental chambers. Tolerates—100°F to +350°F differential. Prompt deliveries. *Tempered glass units and tempered glass now available for rapid delivery.* We also offer engineering service. Write to

THERMOSEAL GLASS CORPORATION
P. O. Box 342
Camden 1, N. J.

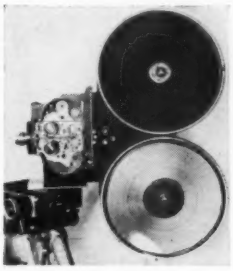
New Products

(Continued from Page 27)

Remote bulb indicating temperature control by **United Electric Controls Co.** Standard units range from -100° and +450°F, and up to +600°F units are available. Controls come in skeleton form to be incorporated or designed into equipment such as incubators, centrifuges, oxygen tents and sterilizers. Type E65N provides setting and indication on single scale. Switch-types also available. Ratings: 15 amp 115/230 volts AC and 20 amp 115/230 volts AC.

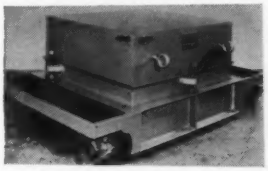
For More Information Circle EQ RSC #13

High film-capacity 16mm movie camera, from **Traid Corp.,** holds 1200 ft. of film for shooting events up to 30 minutes duration. Model 305 Fototracer is lightweight intermittent type developed to film rocket engine testing. It is also suited for uses requiring large film capacities or long-running periods. Runs at 16, 24, 32 or 64 frames per second.



For More Information Circle EQ RSC #14

"Slippery table," oil film horizontal vibration table from **Mantec Div., Wyle Mfg. Corp.** Maker says vertical cross talk is virtually eliminated and horizontal cross talk is reduced to less than 10%—compared to up to 500% of both cross talks in conventional test set-up. Model EP 239 consists of 5,000-lb. block of steel, 36" sq.. with top surface Blanchard-ground to at least a 32 finish and hard-chrome plated. Block is mounted on three leveling pads equidistant from its center of gravity over a 12" deep tank which collects oil draining from top surface. Test specimens are mounted on magnesium slip plates fabricated to suit configurations of individual specimens.



For More Information Circle EQ RSC #15

Packaged environment structures are offered by **Moore & Hanks Co.** with temperature and contaminent control systems, lighting, electricity and plumbing for use where rigidly controlled environment is necessary for testing, assembly, repair or packaging. Temperature may be maintained at ±½°F, humidity held at ±2% relative. High-efficiency filters remove airborne contaminents to .5 microns. Structures, assembled from sectional steel panels, also are expansible, movable. These units may be used as complete buildings, or erected in interiors.

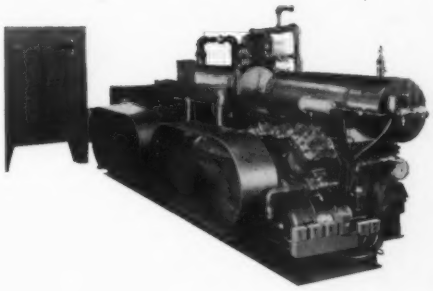
For More Information Circle EQ RSC #16

ATLAS Engineering Corp.

Designers, Engineers and Manufacturers of Environmental Testing Equipment

SPECIAL 100 H.P. CHILLER

DESIGNED TO HANDLE 90 G.P.M. OF METHYLENE CHLORIDE DISSIPATING 60 KW AT −60°F.



WRITE FOR BULLETIN 957 DESCRIBING STANDARD TEST CHAMBERS SIMULATING:

ALTITUDE
HUMIDITY
HI-LOW TEMPERATURES
SAND AND DUST
EXPLOSION
FUNGUS

ATLAS ENGINEERING CORP. WILL DESIGN AND MANUFACTURE, UPON REQUEST, SPECIAL TEST FACILITIES SUCH AS WALK-IN ALTITUDE, TEMPERATURE AND HUMIDITY ROOMS, LIQUID BATHS, ETC.

Atlas ENGINEERING CORP.

26 Custer St. • West Hartford Conn.

ENVIRONMENTAL BUSINESS...

'As Commonplace as the Machine Shop'

Expanded equipment needs . . . more efficient use of existing units . . . automation . . . combined environments . . . extended limits . . . and greater reliance on reliability testing in other than the aviation and missile fields.

These are highlights of the answers received by *Environmental Quarterly* from manufacturers and users of environmental equipment in a random opinion sampling recently on the future of the environmental business.

The answers add up to a picture of optimism for the environmental industry based on expected orderly growth. Following are some typical opinions relative to the business side of the industry. (Technical predictions will be reported on more fully in the July issue.

Stresses Weapons Contracts

"It is our feeling that the environmental field in general will experience a growth of approximately 10 to 20 per cent . . . primarily based on the increased reliability requirements emanating from weapons systems contractors," says Robert H. Levine, technical services manager of United Testing Laboratories, Monterey, Park, Calif.

"Equipment needs should be at least double as related to quality control of manufacturing methods and 50 per cent more in the research and development field," according to Charles F. Conrad, of Conrad, Inc., Holland, Mich., manufacturer of chambers and industrial processing units.

"There is no question but what the environmental simulation field and the associated equipment industry will continue to expand," says R. A. Hawkins, manager of the reliability and quality department at Avco Research and Advanced Development, Wilmington, Mass. "The environmental laboratory is getting to be as commonplace as the machine shop in the modern, space oriented industrial establishment."

'Up 30% in Dollar Volume'

The technical services manager of another leading company predicts succinctly that "the environmental field will increase in size over its present dollar volume by about 30 per cent in 1959-60." And he adds that "we will be discussing altitudes of 200-300 miles" with room temperature environments and a range of acceleration shock testing from ½ G to 500 Gs, "about a 25 per cent expansion over the present day state of the art."

Richard Seidman, chief engineer at Development Engineering Co., Inc., Norwalk, Conn., offers this comment:

"Environmental testing in general will continue to be a steadily growing field, although not at an accelerated pace. It will continue to grow because of new companies entering the field requiring environmental testing, as well as new requirements for existing companies . . .There is a growing appreciation for the need of equipment being tested under simulated operating conditions."

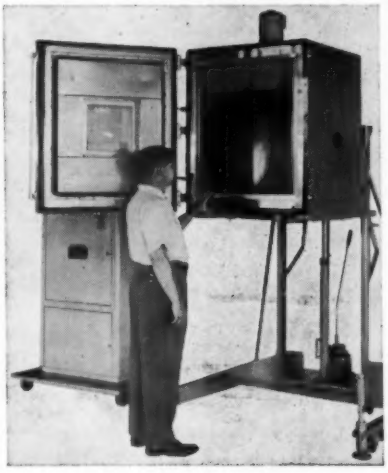
Emphasis on Efficiency

Richard F. Hahn, of United States Testing Company, Hoboken, N. J., predicts more emphasis on utilizing equipment on hand to fuller capacity.

"The large quantities of test items to be handled is going to force automation on those who have not seen it up to this time," he says. "At United States Testing we have invested heavily in automatic read-out and recording equipment and have geared our shop . . . so as to accommodate thousands of different samples within a given moment in a single chamber."

Mr. Hahn expects growth because "there has not been ample equipment available in either of these fields."

New Portable Chamber



Conrad, Inc. has just announced this new portable temperature chamber, Model FBV-8. It can accommodate a vibration exciter head through the bottom, or with an accessory adapter diaphragm, through the side. Temp. range is +800° F. to ambient temperature or with liquid CO2 cooling to about —100° F. (For more information circle EQ RSC #18)

'Barron's', 'Newsweek' Find Environmental Business Good

Estimates of the future of the e vironmental industry came last mon from two independent sources.

In a full-scale review headed "Pr itable Climates," *Barron's*, the fina cial weekly, estimated that some 2 firms in the industry last year did $ million business and said that sal this year are expected to hit $50-m lion, at least.

"With markets broadening rapidl *Barron's* concluded, "prospects for t industry would seem to be as bal as one of its own tropical chambers

The *Barron's* article appeared March 2. On March 23 a second ma national magazine, *Newsweek*, took look at the environmental industry general and Tenney Engineering, In Union, N. J., test chamber manuf turer, in particular.

"As each new plateau is reached the space race," Monroe Seligma president of Tenney, told *Newsweek* readers, "we'll have to build more a better testing equipment—equipme that will have to be able to do thin never dreamed of just five years ago He disclosed that Tenney is workin on a million-foot altitude chamber.

Ling Electronics Unveils Giant Vibration System

Ling Electronics, Inc. unveiled giant vibration testing system rated 175,000 VA power output and fu frequency shaker output of 25,0 pounds force.

Described as the "highest power electronic vibration system produc to date," the four-cubicle assemb measures 18 feet in overall length a 5 feet in depth while the new Li shaker stands almost 6 feet high. (S EQ's Album, Page 19). It will perm vibration testing of large specime and complete assemblies.

Ling is delivering this first ne system to Boeing Aircraft in Seattl Wash. (For more information cir EQ RSC #45).

Belock Lab Is Open to Stude Of Environmental Engineering

Belock Instrument Corporation, lege Point, N. Y., has opened its tensive environmental lab to gradu engineering students of Long Isla Hofstra College. The school, located the heart of a region with many vironmental labs, is believed to be of the first to include environme engineering in its curriculum.

Atlas Engineering Assigned Bowser Service Contracts

When Bowser Technical Refrigeration discontinued operations in the environmental field, Atlas Engineering Corp. was organized at 26 Custer St., West Hartford, Conn., by a group headed by R. C. Biggers. The new firm represents an aggregate of more than 50 years of experience in test chamber manufacturing.

With Mr. Biggers at Atlas are Arthur Schwartz, vice president and chief engineer, and Carl Schectman, secretary-treasurer. All were in key spots at Bowser, and because of their familiarity with BTR equipment, Bowser has arranged for Atlas to service its outstanding equipment. It has turned over pertinent files and records to Atlas.

The Rucker Company Appointed

American Bosch Division of American Bosch Arma Corp. has named The Rucker Company, Oakland, Calif., as exclusive factory representatives and stocking distributors for American Bosch accumulators in California, Oregon, Washington, Nevada, Arizona, Idaho, Alaska and Hawaii. Rucker is maintaining complete stocks and service and repair facilities at its main distribution points in Los Angeles, Oakland, Portland and Seattle.

New Vibration Engineering Service by Unholtz-Dickie

John A. Dickie, former general manager of MB Manufacturing Co., and Karl Unholtz, who was MB's chief engineer, have organized Unholtz-Dickie Corporation in Hamden, Conn. (See EQ's Album, Page 19.) The firm offers professional engineering services on the full scope of vibration problems.

Mr. Dickie, a pioneer in vibration work, is president of the new company. Mr. Unholtz, widely known for his work in aircraft flutter and vibration testing and control systems, is vice president and chief engineering officer. Associated with them are Gerald Reen, secretary, and Donald McCluskey, treasurer, both also former MB engineering executives.

Miscellany: A European subsidiary has been established by *General Controls Co.*, manufacturer of automatic controls. The new company, General Controls, G.m.b.H., is in Dusseldorf, Germany. . . . *CDC Control Services*, Inc., Hatboro, Pa. has received a contract for an undisclosed sum to furnish a pressure control system for the blowdown wind tunnel at Redstone Arsenal.

A share-for-share exchange of common stock will result in the acquisition of Altec Companies, Inc., by *Ling Electronics, Inc.*, if Altec shareholders approve. The plan announced by James J. Ling and G. L. Carrington, chairmen, respectively, of Ling and Altec, calls for Altec and Altec Lansing Corporation to continue operations as Ling subsideriaries with no change in name, management or policies, although Ling's name may be changed to Ling-Altec Electronics, Inc. Ling is a leading producer of vibration testing systems and other high-powered electronic equipment. Altec is in the sound equipment field.

Consolidated Electrodynamics Corporation posted record sales of $32,079,000 in 1958, according to Philip S. Fogg, president and board chairman. However, the company experienced a net loss of $1,178,496 due to non-recurring costs of more than 3½ million dollars, Mr. Fogg said. These costs included inventory write-offs and extra heavy research and engineering investment. Earnings were $771,729, or 73 cents a share, in 1957. . . . *Tenney Engineering, Inc.*, cleared $161,478 in 1958 on sales of $4,501,736, compared to $111,779 on $4,432,188 sales the year before. President Monroe Seligman reported the year-end orders backlog at two million dollars, up half a million over the end of 1957.

Aerotech Specialties Incorporated is now *United Sensor & Control Corp.*, doing business at the same stand, Box 127, Glastonbury, Conn. It is a subsidiary of United Electric Controls Company.

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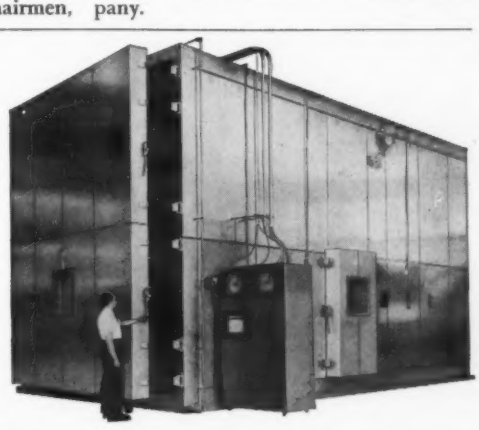
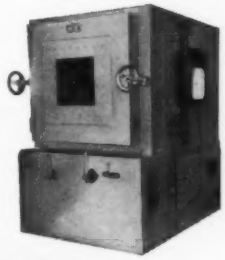
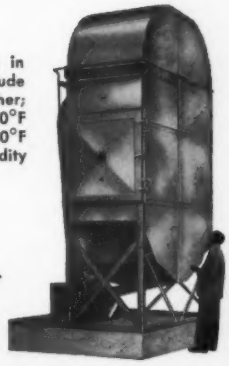


American Research's unique experience in the design and development of test equipment for the most difficult parameters and stringent specifications makes it possible for them to provide you with any type of environmental test chamber to meet your most advanced requirements. Frequently they have already solved similar problems for others. And every American Research chamber incorporates the latest features of testing efficiency and dependability.

Any size test chambers are available from American Research. Room shown above permits a large truck to deliver the test item to the interior without double handling. Components or completed items can be tested through a complete range of simulated environments.



◀ Altitude chambers in any size — Altitude 200,000′ or higher; temperature +500°F and higher to −100°F and lower; Humidity 20% to 95%.



Sand and dust chamber ▶ includes automatic dust density control and streamlined air-flow design.

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(*Continued from Page 4*)

Mfg; W. W. Caldwell, Ling; R. E. Brown, Genisco; J. E. Foster, Collins Radio; H. Lewis, Lockheed Missile Systems Division; G. W. Kamperman, Bolt Beranek & Newman; J. D. Losse, A. C. Spark Plug Division, and O. G. Hancock, Chance Vought).

2. Laboratory philosophy and practices (R. S. Hooper, Sandia Corp.; A. Kuzmickey, Convair-Fort Worth; J. A. Maloney, McDonnell Aircraft; A. H. Ramquist, U. S. Naval Ordnance Lab, China Lake; G. G. Brown, U. S. Testing, and J. M. Mason, Marquardt Aircraft; F. P. McIntee, Chrysler; E. W. Parrott and A. P. Harris, RCAF, and K. Koon, IBM).

3. Modern environmental testing (P. E. Ritt, Melpar; J. Oram, Lockheed Missile Systems; J. R. Herring, Wyle Associates; A. H. Abernathy, Holloman Air Force Base; R. P. Nichols, Chrysler; F. W. Meyn, GE-Utica; F. W. Hardgrove, NASA/NRL; R. W. Hankey, Wright Air Development Center; V. Grose, Boeing; R. Roukas, Chrysler, H. Naubereit, Johnsville, Pa., Naval Air Development Center, R. A. DiTaranto, RCA; F. R. Dube, Kinney Mfg., and A. Surosky, Melpar).

4. Field data and standardization (M. W. Oleson, D. C. Naval Research Lab; J. Carroll and J. Guba, Rome Air Force Base; M. Sigismund, Frankford Arsenal; G. Marks, Defense Department; C. J. Wessel, National Research Council, and J. W. Burgess, Sperry Gyroscope).

5. Ground support equipment environments (H. R. Beaven, Lockheed Missile Systems; J. Jodele, Jet Propulsion Lab, CIT, and Bruno Forsche Hughes Aircraft).

6. Instrumentation (A. I. Drane Gulton; Fred Hermann, Tenney E gineering; D. Arlidge, Consolidat Electrodynamics).

7. Radiation effects (F. E. Hill, Vi ers; H. R. Dvorak, Convair-Fort Wor and R. E. Bowman, Battelle Memor Institute).

Bendix Gets New Chamber

The Bendix Corporation's Kan City plant has installed a custom signed, walk-in environmental cabin built by Hudson Bay Co. (See EQ Album, Pg. 19). The 216-cubic foot u is entirely of metal, so efficiency cann drop because of deterioration of wood parts, and the stainless steel exterior a Monel metal interior are corrosion sistant.

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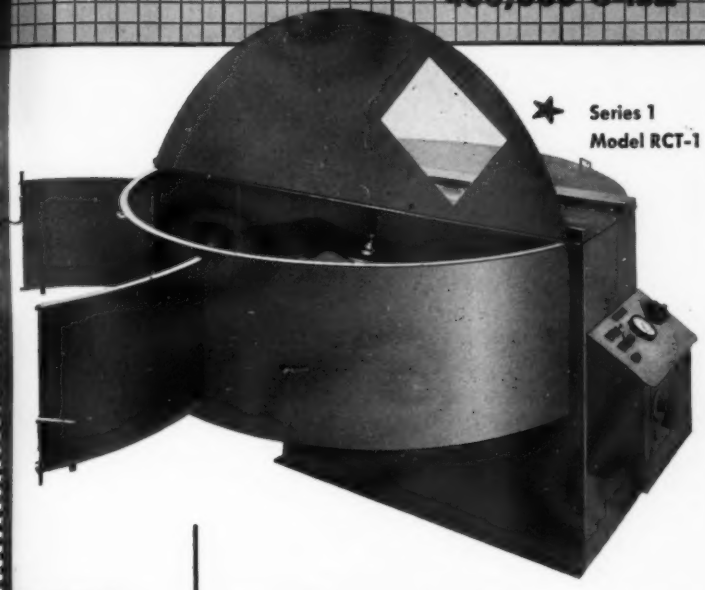

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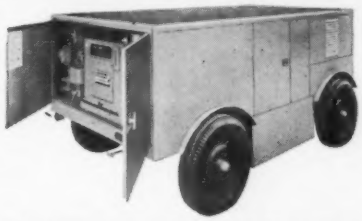

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